AMERICAN MACHINIST

September 6, 1939

Dies Do It—*But dies mean money; reducing their costs gives wider use to die castings, stampings and plastics* (*page 681*)

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CONTENTS

"I Want More Money"..... 667
Shrink Fits Without Flame.....*J. E. Ayers* 671
Where Oil and Metal Mix.....*Fred H. Colvin* 672
"Last Word" in Plastics.....*Herbert Chase* 674
Hard To Machine?.....*Herbert A. Reece* 676
Brilliance Isn't Everything..... 678
Down with Die Cost..... 681
Drawing Die Troubles.....*C. W. Hinman* 683

SHORT ARTICLES

Metal Cleaning Hints.....*John E. Hyler* 685
Automotive Steel.....*E. F. Davis* 701

PRACTICAL LETTERS

Small Bench Hammer.....*Charles H. Willey* 686
Simple Parallel Separators.....*Robert Knotek* 686
Hand-Operated Punch and Die.....*L. Kaspar* 686
Reconditioning Pipe Wrenches.....*Arman Taslyian* 687
New Use for an Old Drill Press.....*George Blum* 687
Fixture for Fluting Twist Drill.....*Herbert M. Darling* 687
Aids for Hand Stamping.....*Martin H. Ball* 688

NEWS OF THE INDUSTRY

Gaging Business..... 690b
Inside Detroit..... 690f
Watching Washington. 690h
Business Items..... 690j
Personals 690k
Obituaries 690k

DEPARTMENTS

What's in This Issue.. 35
Reference Book Sheet. 689
Editorial 69a
Shop Equipment News. 691
Trade Publications.... 700
New Books..... 701

NEXT . . .

Preview of Machine Tool Show

★

Your Preview, Guide and Record of the Machine Tool Show—Use the next issue of *American Machinist* to make your visit to the Machine Tool Show more profitable. Out September 20, it will provide a complete Preview, Guide and Record of the Show.

Editorial pages will furnish an over-all picture of the Show, including a floor plan and list of exhibitors. The "Show in Print" section will carry detailed descriptions of new equipment displayed there for the first time. And advertising pages will give vital information on individual machines and equipment throughout the Show.

COMING SEPT. 20 • MACHINE TOOL SHOW NUMBER • AMERICAN MACHINIST

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

"I Want More Money!"

National Metal Trades' job rating plan substitutes facts for guesswork in deciding whether Bill Smith is getting a fair wage for the work he does

"THE CONTENTS of this envelope should be a confidential matter between you and the management," reads a statement on Bill Smith's pay envelope.

"They needn't worry," mutters Bill, as he steps out of the pay line, "I'm as ashamed of it as they are."

Suppose Bill Smith, after thinking it over, finally goes to his foreman and says he is dissatisfied with his earnings. The foreman may take one of three courses, depending on the way top management has encouraged him to deal with such cases. He may do any one of the following:

1. Tell Bill if he doesn't like it, he knows what he can do.

2. Lead Bill to believe that he agrees with him and would fix it if he had anything to say about it but that "they" won't let him. This makes a good fellow out of the foreman at the expense of top management.

3. Tell Bill that he will be glad to check up and let him know in a few days.

The foreman believes in giving his men a square deal so he sends the complaint up the line for investigation. In deciding whether Bill's complaint is justified, management should ask and answer three questions:

1. What about Bill Smith's job? How does it compare with other jobs in the department?

2. What about Bill Smith? How does he compare with other men on the job?

3. What do other companies in the area pay for this or similar jobs?

When management has the facts on each of these points, then it is in a position to judge whether Bill

Occ. Code No. .....
Dept. .....

JOB RATING SUBSTANTIATING DATA

Job Name ASSEMBLER (ERECTOR) ..... Class A

FACTORS	DEG.	BASIS OF RATING
EDUCATION	3 (42)	Use decimals and fractions, simple geometry. Work from complex drawings, specifications or wiring diagrams. Some knowledge of elementary mechanics and characteristics of materials. Use micrometers, vernier calipers, etc. Equivalent to 2 years high school plus about 2 years trades training.
EXPERIENCE	5 (110)	5 to 8 years in shop, use all types of hand or power tools and simple machine tools such as drill press, pedestal grinder.
INITIATIVE AND INGENUITY	4 (56)	Highly diversified. Intricate erection or assembly requiring accurate adjusting, fitting, aligning. Close tolerances or precision fits. Layout and plan erection procedure. May select materials and parts. May set up details for lower class assemblers, inspect and check their work.
PHYSICAL DEMAND	2 (20)	Light physical effort handling tools, materials, parts. Occasionally work in difficult positions for brief periods only. Heavy work usually done by helpers.
MENTAL OR VISUAL DEMAND	4 (20)	Must concentrate mental and visual attention closely to great number of details. Interpret drawings and specifications. Visualize steps in lay-out and erection. Plan sequence and maintain flow of work.
RESPONSIBILITY FOR EQUIPMENT OR PROCESS	2 (10)	Possible breakage of drills, damage to simple machine tools, power tools, measuring or testing instruments. Probable damage seldom over $25.
RESPONSIBILITY FOR MATERIAL OR PRODUCT	3 (15)	Error in assembly, use of wrong or defective parts, careless fitting, may necessitate tearing down and reassembly of expensive products, with possible scrapping of special parts. Probable loss up to $250.
RESPONSIBILITY FOR SAFETY OF OTHERS	3 (15)	Responsible for directing the handling and positioning of heavy units, where carelessness may result in injury to others. May drop heavy materials or tools on others. Responsible for safeguarding dangerous areas during erection, testing or trial runs.
RESPONSIBILITY FOR WORK OF OTHERS	3 (15)	Responsible usually for directing and instructing one or more helpers or assemblers of lower class.
WORKING CONDITIONS	2 (20)	Good working conditions generally. May be slightly dirty.
UNAVOIDABLE HAZARDS	3 (15)	May crush fingers or toes in handling heavy units or from dropped tools. Possible falls in assembling large apparatus or equipment.
Remarks 2.38.2	336-2	

Fig. 1—Master job rating sheets have been prepared for some 350 occupations which simplify and speed up the application of the job rating plan

Smith's complaint has any merit or whether it's just a try for a raise.

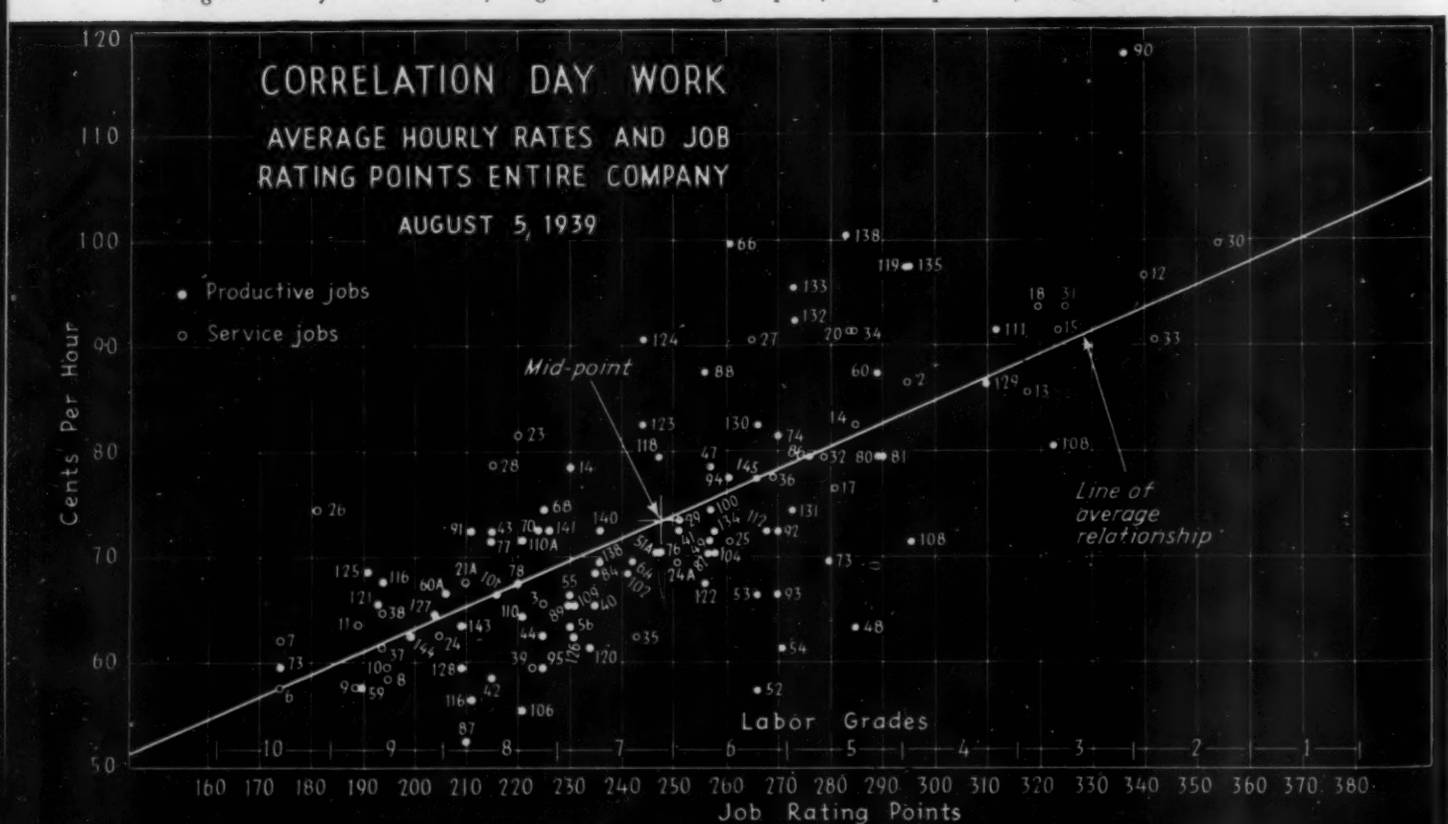
The best way to answer the first question is to rate every job in the plant. The second question can best be answered by adopting a simple employee rating plan. Finally, information as to what other companies pay for comparable jobs can be secured through a wage survey.

Recognizing the increasing importance of fair wage levels and wage differentials between jobs, the National Metal Trades Association has adopted a standard job rating plan for the use of its member companies, and is assisting them in applying it. Since last fall the plan has been installed in some 100 plants, under the direction of A. L. Kress, formerly with the National Electrical Manufacturers Association. Over 10,000 jobs have been analyzed and rated. At the same time, a committee under the direction of O. D. Reich, Dexter Folder Company, has been developing a plan for rating employees, which will be described in a later article.

Eleven Factors Considered

The Metal Trades job rating plan (which is similar to the one recommended by the National Electrical Manufacturers Association) is simple, concise and readily understood by foremen. Eleven factors, common to all types of manufacturing operations, are used. "Skill" (represented by education, experience, and initia-

Fig. 2—Chart correlates hourly earnings and job ratings, provides a graphic picture of plant wage structure and provides a logical basis for correction of wage rates according to qualifications required by the job


CORRELATION DAY WORK
AVERAGE HOURLY RATES AND JOB RATING POINTS ENTIRE COMPANY
AUGUST 5, 1939
• Productive jobs
o Service jobs
Mid-point
Line of average relationship
Cents Per Hour
Average Hourly Earnings, Cents
Labor Grades
10 9 8 7 6 5 4 3 2 1
Job Rating Points
120 110 100 90 80 70 60 50
160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380

tive) is assigned 50 per cent of the total points. "Responsibility" is next with twenty per cent, while "effort" and "job conditions" are each assigned fifteen per cent. The eleven factors and the points assigned to each are shown in Table I. Each factor is broken down into five degrees, with a concise specification for each degree. For example, Table II shows the specifications for rating a job on "Responsibility for Material or Product." The other ten factors are similarly described for rating purposes.

To expedite and simplify the rating of jobs in a plant, about 350 master job rating sheets, similar to Fig. 1, have been developed, based on experience in rating some 10,000 jobs in 100 plants. They constitute a valuable collection of job specifications for a wide range of occupations. In rating jobs, one of three situations comes up:

1. A master sheet will be adapted to fit the specific job in the plant.
2. The master sheet fits the specific job without change.
3. The specific job must be written up in its entirety either because it is peculiar to the plant or there is no master.

The foreman plays an important part in the application of the Metal Trades job rating plan. He furnishes the basic informaiton as to what each job in his department takes, in terms of each one of the eleven factors, and participates in the rating itself. One of the essential steps in rating jobs, such as a turret lathe operator, is to determine how many classes of work there are and to rate each class. After all the jobs in his department have been rated, the foreman is asked to classify his men according to occupations. Without the foremen's interest and cooperation, it would be impossible to develop the necessary information.

When all the jobs in each department have been rated with each foreman, a summary sheet, similar to Fig. 4, is made up. The jobs are arranged in order of grades according to total points scored.

These summary sheets are then carefully reviewed on "education," then "experience" and so on for each of the eleven factors. The purpose of the review is to check any apparent inconsistencies in ratings between jobs or between departments. If there are a large number of assemblers or milling machine operators, for example, in different departments, then these ratings are all brought together on single summary sheets for checking and comparison. In this way, every possible effort has been made to eliminate chances of inconsistencies.

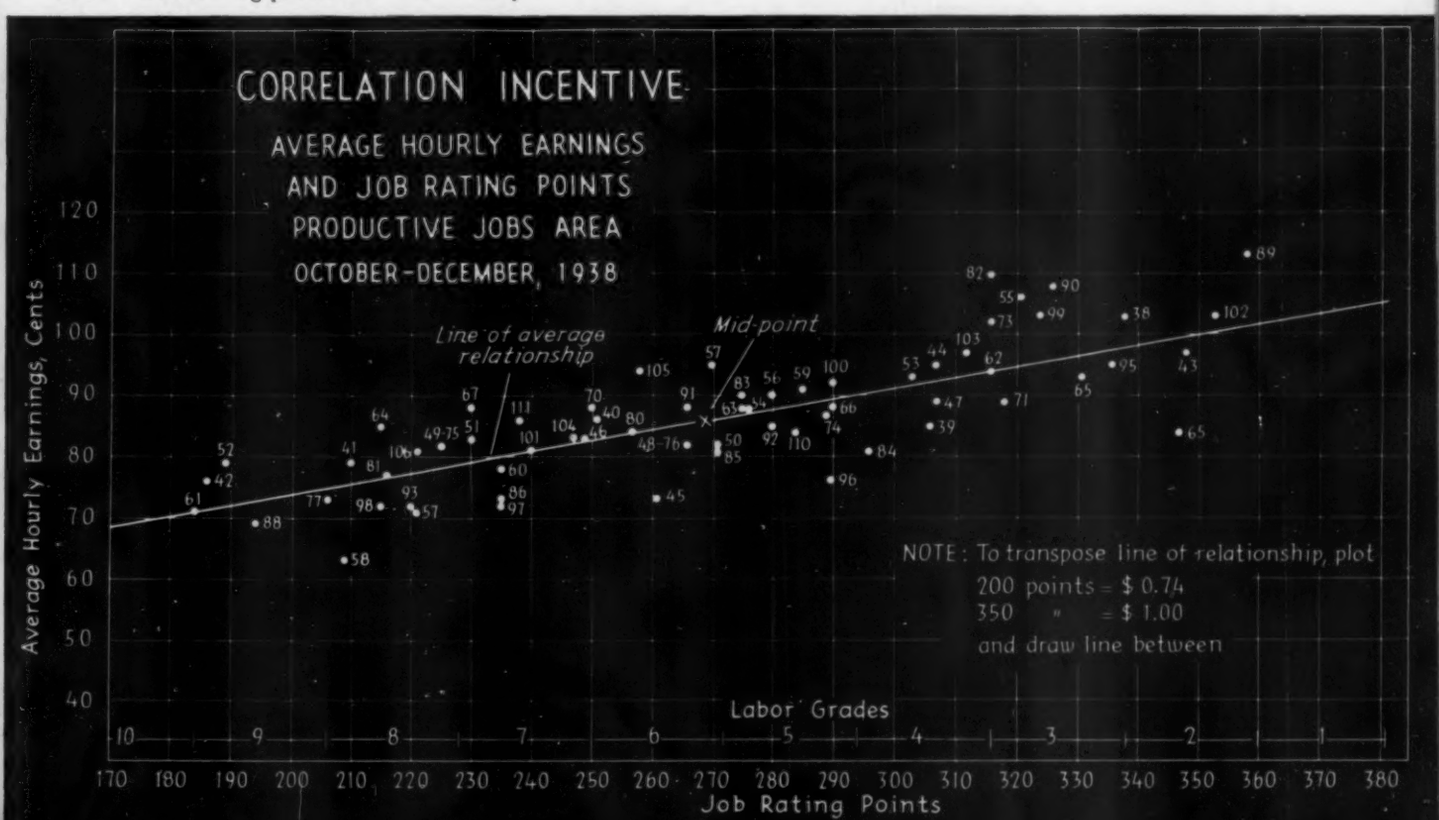
Finally, top management is furnished with a graphic picture of its own wage structure, similar to Fig. 2. This is a simple correlation chart, with average hourly earnings (as one variable) on the left hand scale, plotted against the points which each job rates (job ratings points being the other variable) on the bottom scale. If the job rating plan really does measure the equivalent skill, effort, responsibility and job condi-

TABLE I

POINTS ASSIGNED TO FACTORS

Factors	*1st Degree*	*2nd Degree*	*3rd Degree*	*4th Degree*	*5th Degree*
Skill					
1. Education	14	28	42	56	70
2. Experience	22	44	66	88	110
3. Initiative & Ingenuity	14	28	42	56	70
Effort					
4. Physical Demand	10	20	30	40	50
5. Mental or Visual Demand	5	10	15	20	25
Responsibility					
6. Equipment or Process	5	10	15	20	25
7. Material or Product	5	10	15	20	25
8. Safety of Others	5	10	15	20	25
9. Work of Others	5	..	15	..	25
Job Conditions					
10. Working Conditions	10	20	30	40	50
11. Unavoidable Hazards	5	10	15	20	25

Fig. 3—This chart is similar to Fig. 2 but is the summation of a wage survey in 24 metal-working plants in one community



JOB RATING SUMMARY - PRODUCTIVE OCCUPATIONS - MACHINE SHOP

No.	Occupation	Class	SKILL: Education Deg.	Education Pts.	Experience Deg.	Experience Pts.	Initiative & Ingenuity Deg.	Initiative & Ingenuity Pts.	EFFORT: Physical Demand Deg.	Physical Demand Pts.	Mental-Visual Deg.	Mental-Visual Pts.	RESPONSIBILITY: Equip. or Process Deg.	Equip. or Process Pts.	Material or Product Deg.	Material or Product Pts.	Safety of Others Deg.	Safety of Others Pts.	Work of Others Deg.	Work of Others Pts.	JOB CONDITIONS: Working Conditions Deg.	Working Conditions Pts.	Hazards Deg.	Hazards Pts.	Total Points	Labor Grade
											Labor		Grade		2											
104	Lay-Out Man	A	4	56	5	110	4	56	2	20	4	20	2	10	4	20	3	15	1	5	2	20	3	15	347	2
55	Boring Bar-Horizontal	A	3	42	5	110	4	56	3	30	4	20	3	15	3	15	3	15	1	5	2	20	3	15	343	
45	Assembler-Group Leader	A	3	42	4	88	4	56	3	30	4	20	2	10	2	10	3	15	5	25	3	30	3	15	341	
											Labor		Grade		3											
85	Inspector-Mechanical	B	4	56	4	88	4	56	2	20	4	20	3	15	3	15	3	15	3	15	2	20	3	15	335	3
122	Set-Up Man-Welding	A	3	42	4	88	4	56	3	30	4	20	2	10	2	10	3	15	3	15	3	30	3	15	331	
125	Sheet Metal Worker	A	3	42	4	88	4	56	3	30	3	15	3	15	2	10	3	15	1	5	4	40	3	15	331	
103	Lay-Out Man	A	4	56	5	110	4	56	2	20	4	20	2	10	2	10	2	10	1	5	2	20	2	10	327	
76	Grinder-External	A	3	42	4	88	4	56					3	15	2	10							3			

Fig. 4—Summary sheets assist in making a quick survey and review of all ratings by department, occupations or plant

tions which different jobs take, rates of pay should tend to increase as the points scored increase.

Such a chart shows top management clearly just what jobs are "out of line," either because they pay too much or too little, in relation to other jobs in the plant. Invariably, it will be found that some jobs are underpaid while others are over-paid by comparison. Obviously, no one with any experience in wage administration would advocate a drastic readjustment of rates to try to bring them all in line. This graphic picture of the plant wage structure does, however, give top management a fair and logical basis for the gradual adjustment of wage rates to eliminate inequalities and unfairness. As a matter of fact, it is only through the application of a job rating plan that top management can be assured that rates of pay are comparable for different jobs and that discrimination in rates of pay is being minimized.

The final step in the Metal Trades job rating program is the compilation of area wage surveys based on the job classifications and ratings in each plant. Only in this way is it possible to make adequate wage comparisons. In other words, a plant with Class A, B and C assemblers or erectors wants to make comparisons of its own wage rates in terms of comparable work. The job rating plan becomes the yard-stick whereby comparable work is measured.

In addition to furnishing its members with detailed comparison sheets whereby a company may check its own rates for Class A assemblers against the composite area rates for that class of work, charts similar to Fig. 3 are furnished them which show the general level of wages in the area. By transposing the area "line of average relationship" to its own chart, a company can readily determine whether its own wage level is above or below the area.

The Metal Trades job rating program is unique in that:

1. It represents the first cooperative use by a large group of manufacturers of a standard job rating plan.

2. Every effort is made to secure consistency in rating jobs in each plant and between plants through centralized coordination.

3. The technique developed has proved effective in a wide range of occupations and is equally applicable to other industries.

4. A definite, clear-cut specification is developed for each job rated, setting forth the requirements of each job, and showing why it was rated as it was on each factor.

5. Top management is able to visualize the result of the ratings in terms of its own wage structure through the charts illustrated in Fig. 2. Without such a graphic picture, the results would not be easily interpreted.

6. The ultimate use of the job classification and ratings for area wage survey purposes marks a distinct step forward in assisting companies to appraise their own wage rates in comparison with other companies.

In conclusion, the whole purpose of a job rating program is to minimize inequalities in wage rates, due to lack of proper job classification, where such differences are not warranted by differences in skill, responsibility, effort and working conditions. Job rating is an invaluable tool of management regardless of the size of the plant. Properly applied, it substitutes facts for guesswork in determining "What's the job worth?"

TABLE II **RESPONSIBILITY FOR MATERIAL OR PRODUCT**

	Requirements	*Illustration**
1st Degree.....	Value of material which may be wasted, damaged or lost is small (maximum $10.00) or possibility of loss or damage is slight.	Drill Press Operator (Women) — A, B Drill Press Operator (Sens.) — C Janitor, Sweeper Grinder, Rough
2nd Degree.....	Probable loss due to damage or waste of materials or product is low (maximum $100.00).	Assembler (Men) — C, D Auto. Screw Mach. Operator — A, B, C Laborer Punch Press Operator (Men) — B, C
3rd Degree.....	Probable loss due to damage or waste of material or product is limited (maximum $250.00) or if amount of possible loss is high, probability of occurrence is exceedingly low.	Carpenter — A, B Drill Press Operator (Sens.) — A Grinder, External — A, B Tool and Die Maker — C
4th Degree.....	Probable loss due to waste or damage of material or product is high (maximum $500.00).	Cranemen — A, B Lathe Operator, Engine — A Milling Machine Operator — A Planer Operator — A
5th Degree.....	Value of material which may be wasted, damaged, or lost by the employee is very high, up to several thousand dollars.	Tool and Die Maker — A Watchman, Patrol

* Refer to basic job ratings according to master job sheets and may be modified according to duties assigned in a plant.

A small oven equipped with electric heating units gave uniform fits and eliminated scale and discoloration

By J. E. AYERS
Detroit Edison Company

Shrink Fits Without Flame

A TIME-HONORED method of assemble but one that still finds favor in many lines of work is that of securing tight fits by means of shrinking. The advantages are good contact between surfaces and a high pressure between the mating parts without the necessity of heavy equipment to complete the assembly.

One manufacturer, who used this method for a number of years, employed an open flame to heat the shrunk-on parts. This method of heating never proved entirely satisfactory.

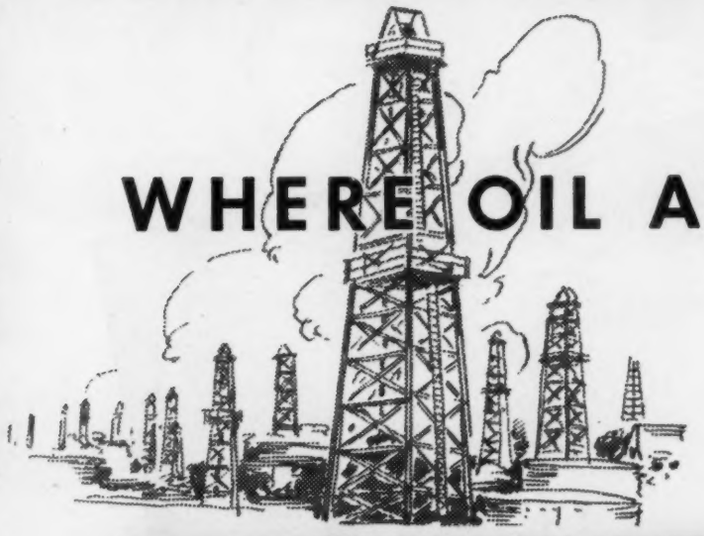
Any judgment as to the evenness or degree of heat rested directly upon the operator with every possibility of variation because of the personal equation. The manufacturer had no control over the process and was unable to rely upon the same result time after time. At times the gears, which were shrunk upon shafts of various sizes, were heated unevenly, producing warp and strain. Under-heating occurred occasionally which necessitated forcing the gears on the shafts with resultant distortion. In other cases, the gears were heated too high, causing discoloration and, in extreme cases, scale.

Looking for an alternative to overcome these faults and also to eliminate the fire hazard of an open flame, the manufacturer hit upon the use of electric heat. This means of heating appeared to offer the opportunity of obtaining a predetermined heat without warp, scale, discoloration or strain.

A small thermostatically controlled oven was selected, having a temperature range up to 300 F. Calculation of heat losses and absorption by the gears indicated that 1500 watts of electric heat would suffice if the finned heaters were inclosed in a small oven insulated with 1½ in. of Air-O-Cell. The oven was made from angle iron, sheet iron and insulation as shown in the accompanying illustration. The frame has over-all dimensions of 24 in. wide, 10 in. deep and 8½ in. high.

Provision was made in the long side for a suitable door. A metal tray to place the work was put in the bottom of the oven about an inch above the floor level. The tray was perforated to permit heat circulation from a 500-watt heating unit placed in the bottom of the oven. Two other 500-watt finned strip heaters were placed on the top and back of the oven respectively. A thermostat control bulb was placed on the rear wall of the oven.

The oven performed as anticipated. Guesswork in assembling no longer rules, with the result that the fit for any gear can be repeated by reference to a chart indicating time and temperature. Rejects and wasted time have been reduced to a vanishing point through the use of this electrically controlled oven.



WHERE OIL AND METAL MIX

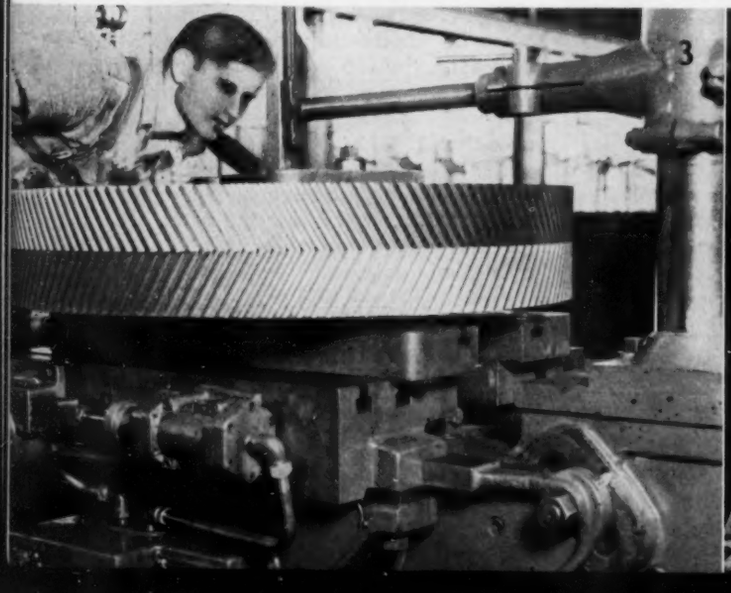
Today's drilling equipment must run as smooth as the oil it delivers. That's why modern metal-working methods have won a place in the petroleum industry

IN THE MANUFACTURE of oil-well drilling and pumping machinery, the Lufkin Foundry & Machine Company, like other concerns in this field, has established specifications which have improved the quality of these products. No longer does the old idea apply that any old fit is good enough for oil-field machinery. Extreme care is exercised in all fabricating operations—the quality of the equipment has been improved by rigid applications of modern engineering principles. This is exemplified by the following and the previously published (*AM*—Vol. 83, page 638) illustrations. With the variety of work done at the Lufkin plant, in which welding and heat-treating plays an important part, there are naturally a number of operations that do not come under the head of usual shop practice. Some of theses operations are also illustrated.

1 *Solid-tooth herringbone gears, with no clearance groove in the center, are used in Lufkin's oil-pumping equipment. The gears are cut on Sykes machines, four of which are installed for this purpose. Gears are flame-hardened, and afterwards run in with their mating pinions. Gear teeth are checked for thickness on the pitch line by a dial gear tooth gage. Center distances of shafts are checked with the mating gears in position. As shown, a gage consisting of a V-block and rod is swung between the two shafts; a feeler indicates the clearance*

2 *Much of Lufkin's oil-well machinery is fabricated by welding. Here is a welding fixture which holds three I-beam legs of a tripod in proper alignment while the ends are welded to plates, these plates being held in position during welding by bolts and taper keys. The fixture is adjustable as to distance between uprights and handles several lengths of legs. The large plate at the right is drilled with numerous holes so that end plates for different size tripods can be bolted in place to give the correct angle and spread to the legs*

3 *Keyways in large gears are cut in this machine, the horizontal bar shown being used to hold the keyseating cutter bar against the tool thrust*



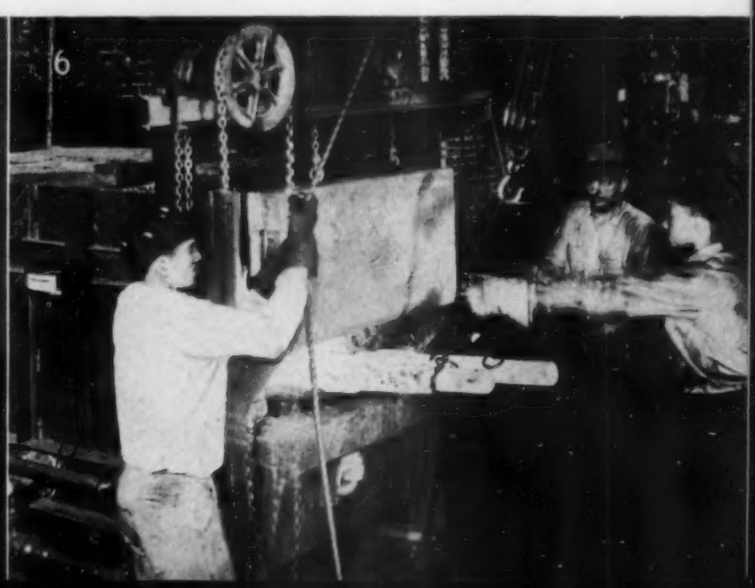
By FRED H. COLVIN
Editor Emeritus, American Machinist

After the gears are mounted on their shaft, they are run in with the mating pinions, using generous amounts of lapping compound

4 *The spherical bearing shown, with stub shaft inserted, fits the back end of a connecting rod for a pumping unit. Clearance between the stub shaft and bearing is checked with calipers, giving the relative diameter of the shaft and the hole. After the shaft is pulled up into place, the larger diameter of the shaft fits the bearing hole to a working clearance, this clearance being checked with a feeler gage for accurate tolerance*

5 *Walking beams fabricated by welding from flame-cut plates are bored while mounted on this truck fixture. The substantial clamp for holding the work is supported at the top and bottom, and can be swung out of the way for convenience in loading and unloading*

6 *Heat-treating plays an important part in the manufacture of oil-well machinery. This furnace, equipped with a pyrometer to insure uniform results, is one of several used in treating parts of drilling and pumping machinery. Two pinion shafts are shown being removed from the furnace*

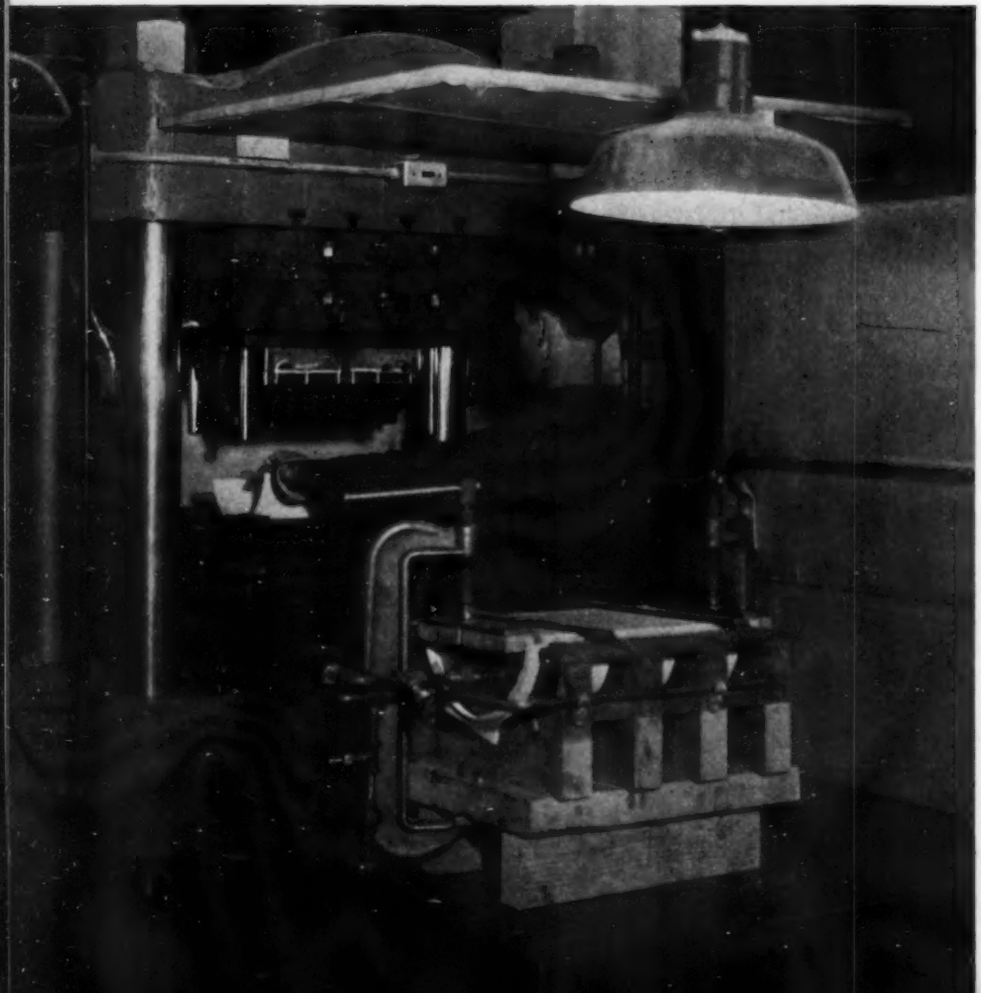


Urea cups are produced in this twelve-cavity mold, their handles being shaped by removable lugs lifted out with the cups. The lugs are afterward separated and set into the fixture in left foreground. The fixture is used to load the lugs in thejr respective mold recesses

"Last Word" in Plastics

New Reynolds molding plant features continuous flow of materials, injection molding on large scale and unusual measures for cleanliness

By HERBERT CHASE

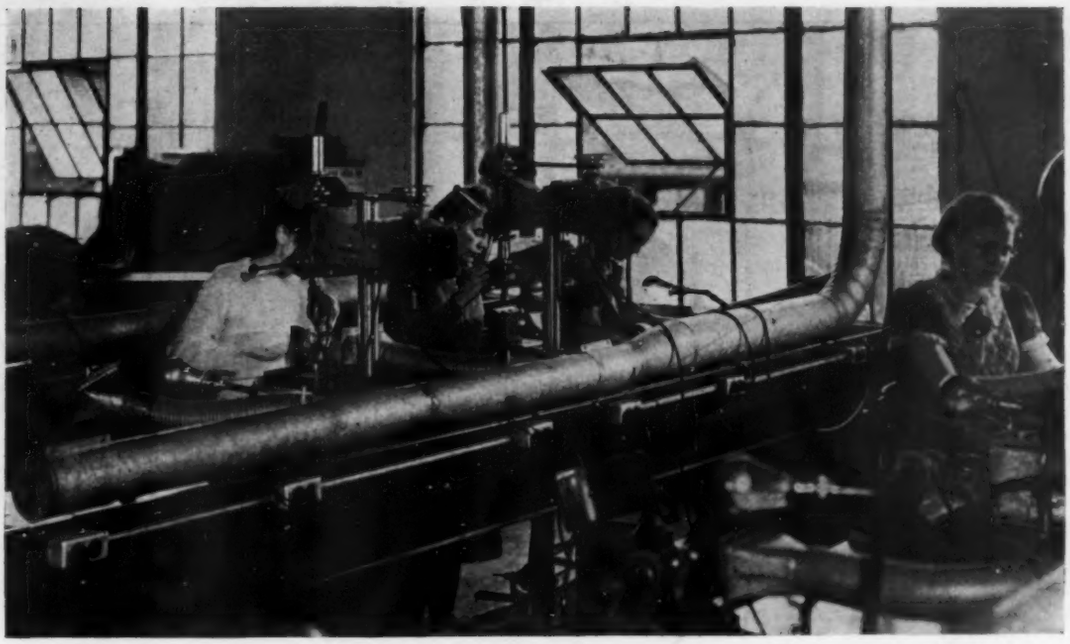


This press is used for molding a part of a Toledo scale housing in white Plaskon. The wooden fixture in the foreground clamps the molding and prevents it from warping

IT'S ONLY in recent years you've heard much about plastics, but Reynolds Spring Company has been at the job of making plastic products since 1921. In that year it set up 14 molding presses in a plant then devoted exclusively to manufacture of springs for automobile cushions. Through the years the plastics division has grown steadily into a major activity until last year it was equipped with 108 presses and 10 injection molding machines. Further growth led to erection of a new plant at Cambridge, Ohio.

The Cambridge factory is arranged for continuous flow of materials. Its equipment includes 40 large presses; two injection molding machines; complete steam generating, hydraulic and air compressing units; several preforming (pilling) machines; and numerous machine tools.

A central dust-collecting system helps to keep the plant and the products clean. In fact, a large group of presses used for molding Plaskon, a urea material in white and ivory, occupies a special room partitioned off in glass and kept closed to prevent dust from entering. Each preforming machine for white or light-colored "pills" is installed in a



Some of the benches employed for removing fins and doing any machine work required on molded parts are equipped with exhaust outlets for removing chips and dust. Light machine tools are shifted about as required for efficient work on different lots of moldings

separate room to avoid dust from one machine contaminating pills produced on another.

In the Plaskon room there are four 400-ton and four 180-ton presses used mostly for molding the eight parts which form the entire housing of Toledo Guardian Duplex Scales. The moldings are cured 4½ min. at 300 F. Upon removal from the mold, some of the parts are placed in wooden clamps which prevent warpage while the pieces cool. In some instances, cooling is done under a weight in water and in others under an air blast. Certain parts are clamped in metal forms and cooled in water to avoid warpage.

Among the parts molded in large quantities from light-tinted Plaskon are cups with handles. This work is done in twelve-capacity molds; in order to mold the handle, the opening for which constitutes an undercut, it is necessary to employ a pair of hardened lugs. These are ejected with the cup moldings which, when free, are lifted out of the mold by hand. Before the mold can be recharged and closed it is necessary to place the respective pairs of lugs in the recesses made for them in the mold. This work is facilitated by using a loading frame having a recess for each pair of lugs. As the latter are removed from the cups, they are placed in the frame which when filled is shifted onto the parting face of the mold and the lugs released. This saves time in handling and permits running on a 3 to 3½ min. cycle, of which 2 min. are required for the cure. One preform per cavity is used in this work and, since the preforms are preheated, it is not necessary to "breathe" the mold (open it before curing is completed to release gas), which also saves time.

Presses employed chiefly or entirely for black and dark colors stand in an open molding room. These are arranged in long rows with backs toward welded pipe lines which supply water at 500 to 2700 lb. per sq. in. pressure for press operation, low-pressure water for cooling, steam at 150 lb. per sq. in. for mold heating, and air at 100 lb. per sq. in. for blowing out molds. Plenty of room around presses helps to facilitate mold set-ups. Operators work on wood platforms at convenient height to reach molds and press controls. Opposite each press is a movable bench on which molding sand loose mold parts and inserts are placed and on which electrically heated ovens for warming preforms are often located. Wherever possible, molding is done with preforms to save time in weighing powders as well as in handling the charge. When powders are required they are weighed out or measured volumetrically in special enclosed cabinets facing the presses. The cabinets and measuring apparatus are designed to prevent dust from contaminating the charge.

Certain radio cabinets produced have side openings at right angles to the "force" which forms the interior. This requires the use of side plungers (side cores) which have to be held in place against a pressure of 3200 lb. per sq. in. applied to the plastic. To operate these side cores, the molds are provided with a separate hydraulic cylinder and ram for each core, the cylinder being piped to the same hydraulic system which supplies the press so that core operation is easily effected by suitable valves. This may increase mold costs somewhat as compared with screw-operated cores, but it saves time in molding.

Many small parts are molded in thermoplastics, such as Tenite, in injection molding machines. Larger parts in the same type of materials are also produced in regular compression presses, but require the use of molds arranged for alternate heating and cooling, the latter being done by cold water piped to all presses. In injection molding, the mold remains relatively cold throughout the cycle, but with the two presses available, the charge per cycle is limited to 8 oz.

After molding, parts are finish-polished with small portable drill presses, grinders and bench lathes. Exhaust pipes with outlets on flexible tubing branches carry away chips and dust broken or cut from the moldings. Some pieces require hand filing of fins, but power tools are used wherever feasible, these tools being equipped with holding fixtures when required.

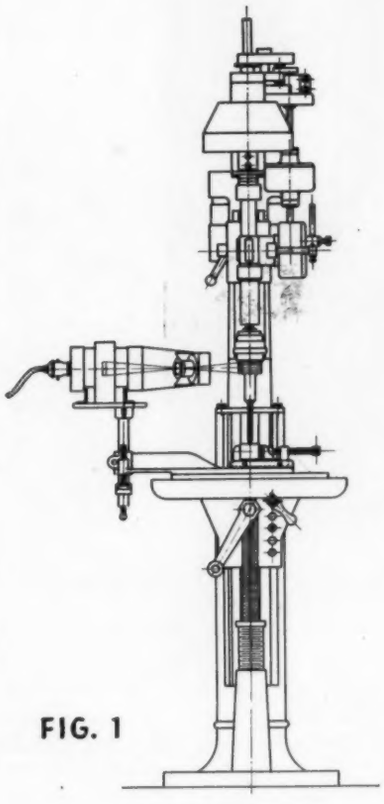


FIG. 1

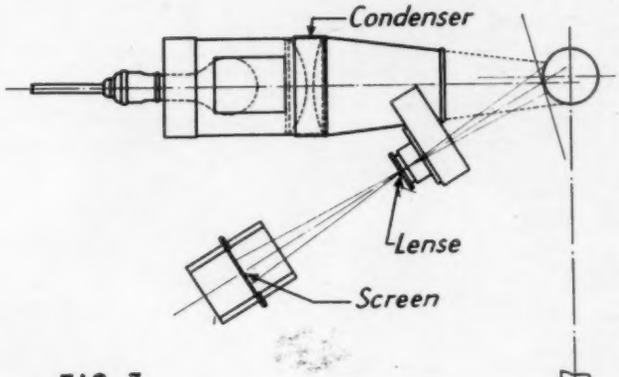


FIG. 3

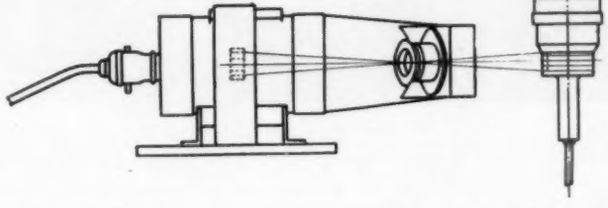


Fig. 1—A standard drill press arranged with automatic feed is equipped with a device for measuring thrust pressures to determine machinability ratings of different materials. Fig. 3—Index grooves on the rotating cylinder are reflected onto the fixed screen by the optical head. The operator can determine accurately the amount the spring is compressed during a test run by observing reflections on the screen

Hard to Machine?

Machinability has so far defied accurate measurement. But the Dalcher test does provide a common rating standard

MACHINABILITY ratings have been sought in numerous investigations. A variety of machine tools and measuring devices have been used by research workers for the purpose of determining definite relations between different materials and types of cutting tools. Few of such tests have developed a common standard upon which rating factors for different materials can be based.

Consisting of a drill press, with automatic feed, Fig. 1, on the spindle of which is mounted a head for measuring spindle thrust, the Dalcher tester provides a means for rating machinability on a uniform basis. The measuring head, Fig. 2, consists essentially of two telescoping bodies held apart by an accurately calibrated spring. The upper body is secured to the end of the drill spindle, while the lower body carries a chuck for holding the standard test drill.

Index grooves turned in the chrome-plated outer surface of the lower body provide a means for measuring the amount the spring is compressed during a given test run. To obtain accurate readings while the spindle and test head are revolving, an optical unit, Fig. 3, is secured to the table of the drill press. Light from the lamp is directed by condenser lenses onto the index sleeve. Reflected light rays then are directed onto a screen through an intermediate lens. An enlarged image of the index grooves appears on the screen as stationary lines, easily observed while the machine is in operation.

Each test piece first is provided with a small, standard-diameter pilot hole. This eliminates errors due to point pressure on the test drill and insures that only the cutting action of the drill will be involved in the test readings.

After the pilot drill has been removed a standard $\frac{3}{8}$-in. diameter test drill is inserted and the drill press set for a proper speed and feed, depending on the material to be tested. The high-speed steel test drills have polished flutes and are ground in a standard drill pointer. Before each use the drill points are inspected

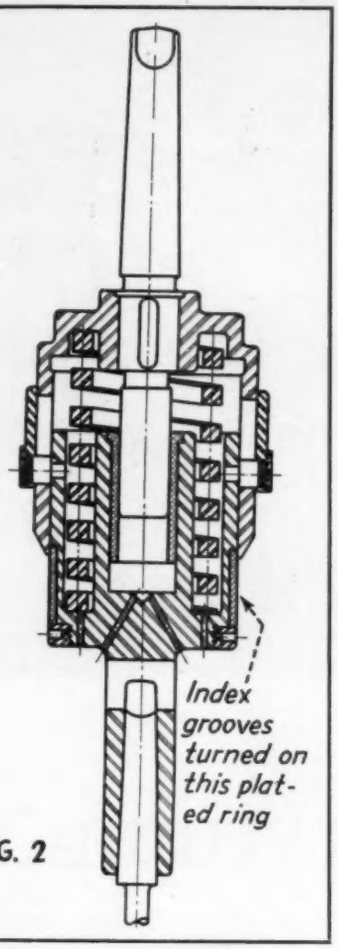


FIG. 2

Fig. 2—The thrust head consists of two telescoping cylinders held apart by an accurately calibrated spring. They are joined by sliding keys so as to rotate the drill

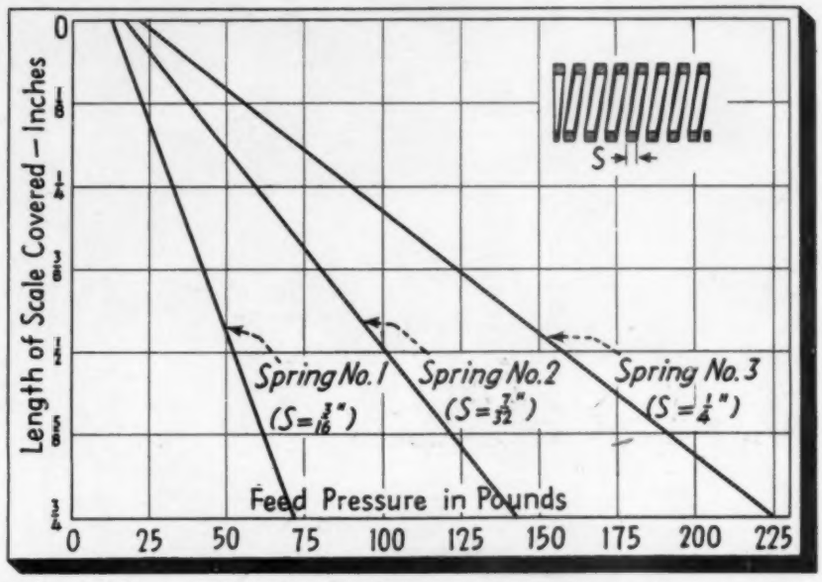


Fig. 4—Springs of differing characteristics can be used, as readings for depth of spring compression are translated into pounds of thrust pressure by charts similar to this. Each spring is recalibrated frequently to insure consistent results

MACHINABILITY RATINGS FOR CAST METALS

Specimen	Tensile Strength Lb. per Sq. In.	Compression Strength Lb. per Sq. In.	Brinell Hardness	Dalcher Rating Pounds
Gray Iron	26,460	114,000	—	41
Air-Furnace Gun Iron	40,000	—	210–220	58
High-Test Iron	57,000	—	285	67
Ni-Resist Iron	25,000	—	131	38
Meehanite — Grade GA	58,600	176,000	—	49
Meehanite — Grade GB	49,800	164,000	—	51
Meehanite — Grade GC	43,400	152,000	—	48
Meehanite — Grade E	31,500	126,000	—	38

MACHINABILITY RATINGS FOR S.A.E. STEELS

Specimen S. A. E. Grade	Quench (30 min.)	Temper (2 Hours)	Brinell Hardness	Dalcher Rating Pounds
1040	1525 F.— Water	1150 F.— Air	197	58
1040	1525 F.— Water	1200 F.— Air	183	56
1040	1525 F.— Water	1250 F.— Air	170	62
1040	1525 F.— Water	1300 F.— Air	163	58
1040	No Heat-Treatment	No Temper	152	43
3140	1525 F.— Oil	1050 F.— Air	255	53
3140	1525 F.— Oil	1200 F.— Air	248	56
3140	1525 F.— Oil	1250 F.— Air	241	58
3140	1525 F.— Oil	1300 F.— Air	223	56
3140	No Heat-Treatment	No Temper	302	38
3435	1475 F.— Oil	1150 F.— Air	269	62
3435	1475 F.— Oil	1200 F.— Air	248	58
3435	1475 F.— Oil	1250 F.— Air	255	59
3435	1475 F.— Oil	1300 F.— Air	262	53
3435	No Heat-Treatment	No Temper	197	60
6140	1600 F.— Oil	1150 F.— Air	277	48
6140	1600 F.— Oil	1200 F.— Air	255	49
6140	1600 F.— Oil	1250 F.— Air	223	56
6140	1600 F.— Oil	1300 F.— Air	207	61
6140	No Heat-Treatment	No Temper	152	59

By HERBERT A. REECE
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under a microscope to make sure that the cutting edges are sharp and that burrs left by the grinder have been removed with a hand stone.

As the test drill enters the material, the calibrated spring is compressed an amount equal to the pressure required. Calibration curves, such as those shown in Fig. 4, are maintained for each test spring. These interchangeable springs are checked at frequent intervals to insure the accuracy of test results. Repeated test runs have shown that values obtained are reproduceable within close limits. Accompanying tables indicate machinability ratings, in terms of thrust pressures, for a number of materials.

Brilliance Isn't Everything

It takes more than candlepower to light a plant properly. Light quality is needed, too, as new I. E. S. standards show

By W. H. KAHLER
Cleveland Lighting Division
Westinghouse Electric & Manufacturing Company

WHAT IS adequate plant lighting? "Plenty of light in the right place," most shop men might say. If they did, they'd be only half right. For light intensity is only half the story. Recent investigations have proved the equal importance of light *quality*.

In machine shops especially, where much precision depends on distinguishing fine graduations ruled on metal, the quality of light is of tremendous importance. One lamp may produce nothing but a dazzle from an object such as a steel scale, while another of the same intensity might make the markings stand out like the proverbial sore thumb.

Naturally, light quality can't be measured with a meter. Intensity, yes. Even color, yes. But quality—including such factors as glare, contrast and distribution—no. To cope with this situation the Illuminating Engineering Society's committee on lighting practice has developed a new technique to determine correct light for efficient seeing. It has used the new method to analyze various types of industrial lighting problems, and has published several detailed reports for machine shops (Ref. 1–4). Analysis begins with the following approach (Ref. 2): (1) What must be seen? (2) How is it seen? (3) What quantity and quality of lighting will produce the most efficient seeing?

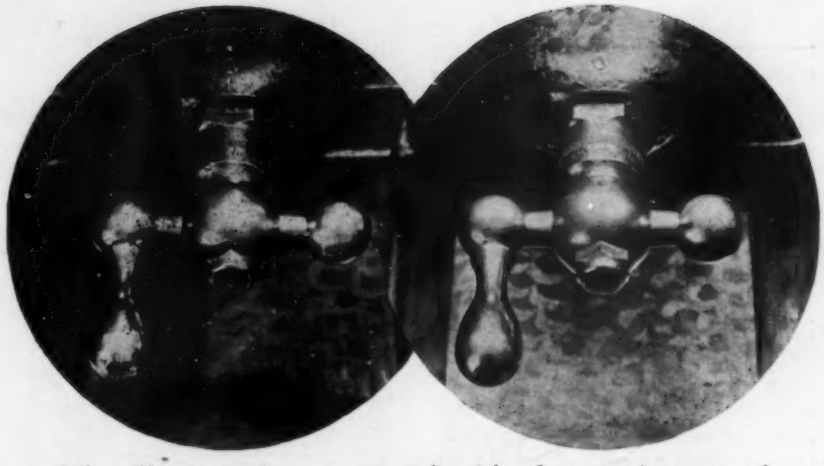
Requirements Vary

Visual tasks in a machine shop are of wide variety. The required accuracy of seeing depends upon the class of work and precision. It has been found that the most exacting tasks involve the discrimination of fine detail on specular metal surfaces. The majority of these visual tasks are reading flat scales, circular barrel micrometers and graduated dials, and following scribed markings on a metal surface.

Available equipment, machine-shop conditions and budget limitations usually make necessary a compromise between the theoretically correct and the practical solution to lighting problems. The following recommendations offer solutions which are practical and satisfactory for accurate and efficient seeing.

General lighting is most important and should be planned carefully to be uniformly distributed, free of direct or reflected glare, and well diffused. Minimum recommended illumination values are given in Table I, but it should be remembered that *quality*

An average illumination of 13 foot-candles is provided by 200-watt "Glas-steel" diffusers on 10 x 12 ft. spacing in the machine shop at Industrial Rayon Corporation's new Painesville, Ohio, plant



When illuminated by open-type industrial reflectors, micrometer adjustment collars on lathes and other machine tools are difficult to read because of the poor contrast. They become easy to read when illuminated by continuous low-brightness sources as at the right

of lighting is just as important as quantity.

The *quantity of illumination,* measured in foot candles, is determined by the size of lamps, photometric characteristics of the lighting units and spacing. The *quality of lighting* depends upon the luminaire design, spacing, mounting height and type of lamp.

Two Types of Lamp Used

There are several different light sources available, but the incandescent and mercury vapor types are used for practically all industrial applications. The incandescent lamp is used most extensively because of the great variety of types and sizes, and relatively low cost.

The mercury lamp is inherently an arc source and must be operated from a transformer or reactor which provides the correct starting voltage and operating current. Its major advantages are high efficiency, long life and good color characteristics for certain applications. The spectrum entirely lacks red and orange, and therefore should not be used where color discrimination is important. By combining certain proportions of mercury and incandescent lamps, this color discrepancy is corrected and it is possible to approach daylight color quality. The lamp, operating on alternating current, has a stroboscopic effect which may beco meannoying and dangerous with high-speed machinery. This effect can be eliminated by special auxiliaries, three-phase alternate connections, or by combining mercury and incandescent lamps.

The fluorescent lamp, newest light source, is receiving wide acceptance in industry, because of its high efficiency, daylight color quality, long life and low brightness. Auxiliaries also are required for these lamps. Most applications to date have been for supplementary lighting, but several trial installations of general lighting indicate broad possibilities in this field.

TABLE I **Illumination for Machine Shops**

Minimum Recommended Standards

Type of Work	*Minimum Light Foot Candles*
Rough bench and machine work	10
Medium bench and machine work, ordinary automatic machines, rough grinding, medium polishing and buffing	20
Fine bench and machine work, fine automatic machines, medium grinding, fine buffing and polishing	50–100*
Extra fine bench and machine work, fine grinding	100–200**

* 10–20 foot-candles general illumination plus supplementary lighting.
** 20–30 foot-candles general illumination plus supplementary lighting.

TABLE II **Room Efficiencies**

Mounting Height (Feet)	*Luminaire*	*Type of Lamp*	*Room Efficiency*		
			*A**	*B**	*C**
10–18	Glassteel diffuser	Clear	0.40	0.35	0.25
10–20	Mercury combination unit	Clear	0.40	0.35	0.25
10–20	Silvered bowl diffuser	Silvered Bowl	0.48	0.43	0.35
18–30	Spread high bay	Inside Frosted	0.55	0.49	0.39
30–50	Concentrating high bay	Clear	0.50	0.44	0.35

* Use Room Ratio: *A*, where room width equals 4 times mounting height.
B, where room width equals 2 times mounting height.
C, where room width equals mounting height.

Spacing is Important

Luminaries in which the bare lamps are shielded should be selected for minimum glare and best diffiusion. Glassteel diffusers, silvered bowl diffusers, or mercury-incandescent combination units meet this requirement. Where the mounting height exceeds eighteen feet aluminum high-bay reflectors give the most efficient results, but reflectors should be sufficiently deep to shield the lamp. The ratio of spacing to mounting height is important for uniform distribution, and manufacturer's recommendations should be followed.

The following formula offers a simplified method for calculating approximate expected footcandle values of general illumination:

$$F = \frac{L \times E}{A}$$

Where: F = foot candles, L = lamp lumens per outlet, E = room efficiency, and A = area per outlet. The lamp lumens and room efficiency are found in Tables II and III respectively. Area per outlet equals total

TABLE III—**Lumen Output of Mazda Lamps**

Watts	*Lumens*	*Watts*	*Lumens*
150	2,610	750	14,550
200	3,640	1,000	20,700
300	5,760	250-mercury	7,500
500	10,050	400-mercury	16,000

area of room divided by number of outlets.

Higher intensities and better quality of illumination are required for many precision machine shop tasks. Supplementary equipment is used to meet these requirements. Localized lighting should never be used without general illumination because bright spots in a dark room cause eye strain and fatigue. In general, the ratio of the brightness of work to surroundings should not exceed ten to one. (Ref. 4).

Carefully designed general illumination is adequate for rough and medium machine work. For more exacting work, operators are constantly reading graduations on scales or micrometer feeds and machine adjustments. Supplementary lighting equipment provides high visibility of these detailed seeing tasks if carefully selected and installed. Each machine is an individual problem and should be treated with expert attention.

Low-Brightness for Lathes

For the precision lathe, a low-brightness continuous source will increase visibility and provide comfortable seeing conditions. In addition, a small concentrating reflector is recommended for boring operations. This reflector should be adjustable and designed to prevent direct glare.

Bench work includes a wide range of hand operations. General lighting is satisfactory for most bench tasks where fine precision is not a prime factor. If the bench is against a wall, reflectors should be no more than 3 to 3½ feet from the wall to prevent shadows.

Exacting bench work requires supplementary lighting for reading scales and micrometers or for fine inspection. Scribing on metal surfaces is a most difficult seeing task and lighting for this operation depends upon the type of surface. Scribed lines on metals treated with a dark coating can be seen best when illuminated by a low-brightness, large-area source. If the metal surface is specular and not coated, a concentrating directional source provides highest visibility, but the piece must be oriented properly by the worker.

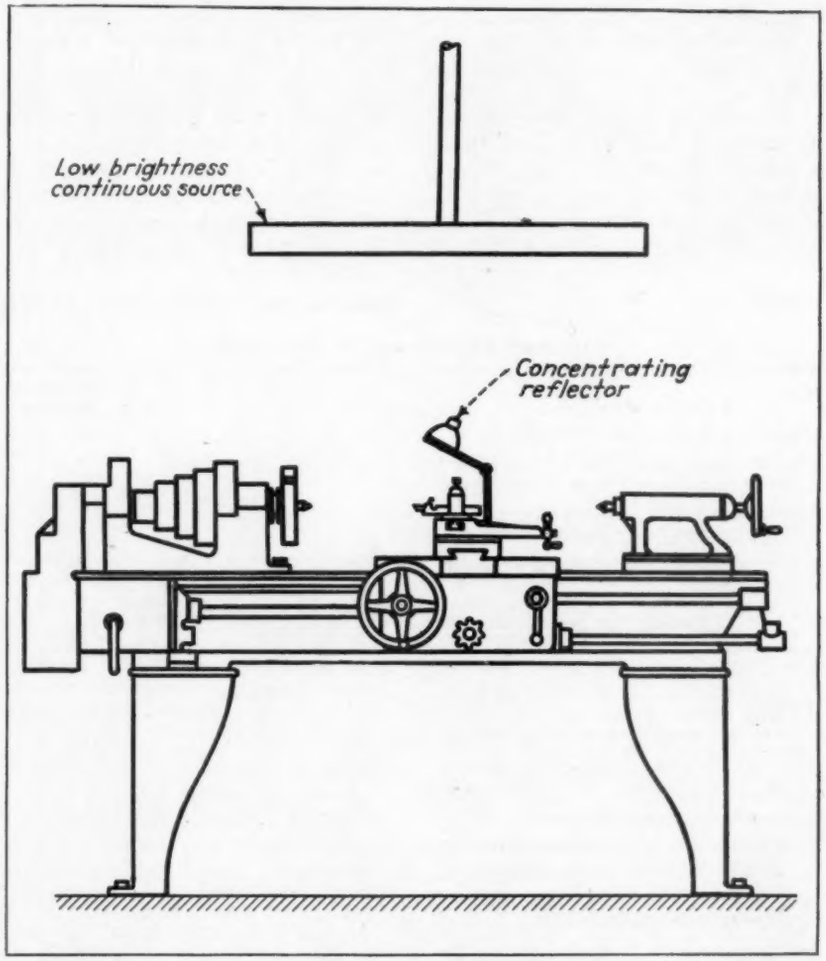
Proper Maintenance Essential

One important factor in designing and maintaining *lighting for seeing* is to provide proper surroundings. Light surfaces of high reflection factor lead to illumination of better quality and most efficient utilization of light. Upper walls and ceilings should be finished with an egg-shell white and lower portion of walls should be a darker color.

Lighting equipment, like other industrial apparatus becomes dirty and should be cleaned at regular intervals. Foot candle values are reduced sharply if maintenance is neglected.

Many plants have found that the best lighting is maintained by assigning individual responsibility for all lighting equipment to one man. He becomes familiar with all types of lighting apparatus throughout the plant, setting up a regular cleaning schedule and replacing burned-out lamps with the correct type and size. Equipment is correctly repaired with proper replacement parts. This man also should keep up with latest lighting developments and keep on file up-to-date lighting literature and catalogs.

There are usually several solutions to any illumination problem, but to find the best answer requires a careful study of all factors, both humanitarian and economical. We must remember that in designing lighting, we are providing the most useful partner for the eyes of the workers. "Lighting for seeing" is a sound investment and pays a dollars-and-cents return.



A low-brightness continuous source will increase visibility and provide comfortable seeing conditions for precision lathe work. In addition a small concentrating reflector, as shown, is recommended for boring operations

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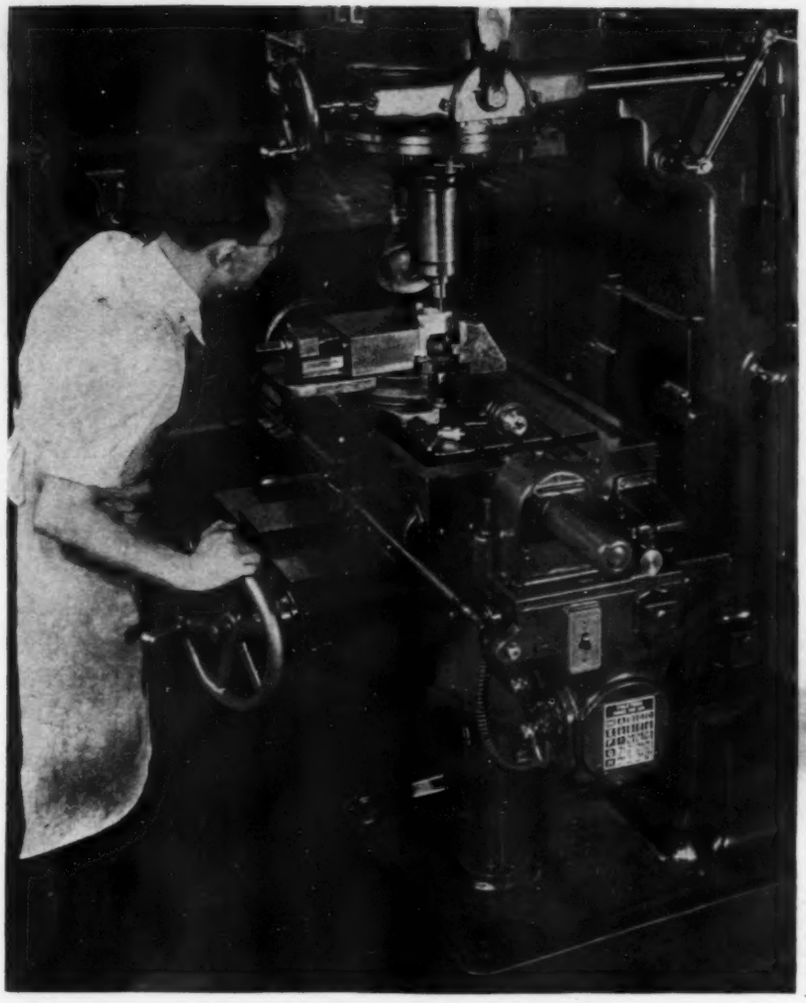


Down With Die Cost

The development of any number of radii, arcs or angular surfaces, as well as the drilling and boring of holes, milling cores in solid, boring for bosses, cherrying and the cutting of males and female spheres in dies can be accomplished on this rotary head milling machine without moving the die from a fixed location on the table

Doehler does it by a new method that reduces an intricate layout to a simple mechanical operation. Here's how

INITIAL TOOLING in the manufacture of items made with dies involves much expense and time. Each die maker spends the greater portion of his time in planning, laying out, making set-ups for milling radii, arcs and angular surfaces, and developing surfaces in both horizontal and vertical planes. Actually, only a small portion of his time is spent in cutting steel. When quick deliveries are demanded, it is often necessary for two or more mechanics, working on a two-shift basis, to collaborate in making the dies. Inasmuch as each die maker usually selects his own approach to each layout problem, there is considerable duplication in planning and setting up each job before actual machining begins.

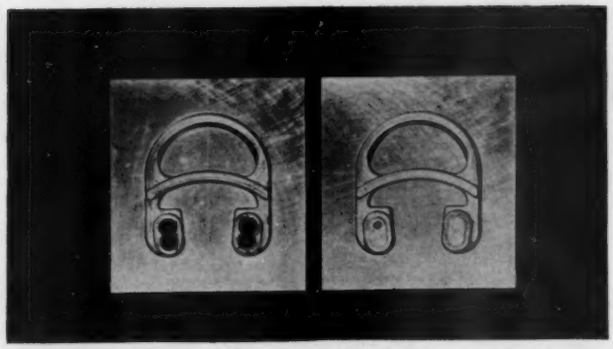
Any reduction in die costs means the elimination of such duplication as well as finding some means to minimize the number of set-ups for milling, drilling and boring operations. These factors must be given constant consideration in industries where once the dies are completed the rapid production of the products involves but routine stamping, pressing, drawing or die-casting operations.

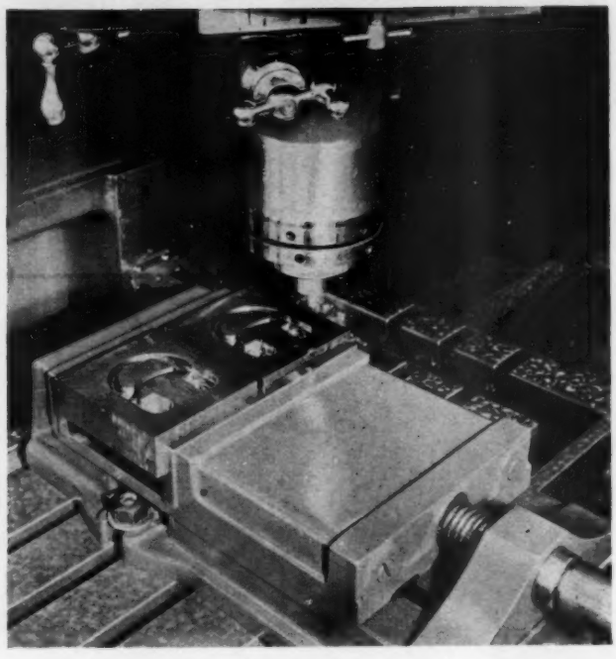
Take the Doehler Die Casting Company for instance. Producing thousands of zinc and aluminum alloy die castings annually, it must hold die costs to an absolute minimum. Competition demands it.

This has been accomplished by substituting for the usual die maker's technique a definite mechanical method of laying out and setting up the die, using for this purpose a Milwaukee rotary head tool and die milling machine. In fabricating dies on this machine, the job is located on the table, after which it is not moved or reset in respect to the machine until it is finished; the die is laid out according to center lines and all measurements are taken from a common base line.

Transverse and longitudinal table movements are used for locating the center of radii, arcs and surfaces the same as on a jig borer. The development of the radii, arcs and surfaces in either a horizontal or vertical plane on a single die is created by a rotary head similar to a circular milling-machine table inverted, in which is mounted a high-speed spindle. This spindle is mounted on a cross-slide permitting it to be set off center radially by means of a micrometer adjusting screw. A hand or power-feed movable quill is used to drill and precision bore small holes. Vertical radii are cut with a cherrying device, which when used in combination with the rotary head motion can generate male or female spherical cherries, or any part of a sphere, and

Below. The production of die castings is but a routine machine operation once the dies are completed. The Doehler Die Casting Company has effected some economies by eliminating between 60 and 80 per cent of the set-up time involved in making the dies, enabling each mechanic to produce 40 per cent more die work





Right. Here is a typical example of how die costs can be reduced—both halves of this die-casting die were worked together; all layout, milling and boring operations were completed from a solid block in one set-up, requiring 22 man hours

can cut conical cavities and projections. Any angle from 0 to 360 deg. can be milled. Other attachments are used for slotting and milling.

The Doehler company is now constructing its dies without moving them once they are located on the machine table. This has eliminated between 60 and 80 per cent of the set-up time involved in the method used previously requiring the layout of each radii, arc and angular surface and making separate set-ups for each by means of a button or a location as, for example, on a circular-table milling machine. It has been found that each mechanic produces 40 per cent more die work by using this new machine. Working on a two-shift basis, mechanics do not duplicate each other's work, thus further increasing die production.

After the Doehler Company receives an order for a die casting, the die is designed and machined as described. It is then ground and filed to close limits of accuracy to assure precise and fast production in the castings department. However, the quality of the work produced by the machine has minimized much of the laborious hand finishing, and fitting and assembling of die parts, dowel pins and push rods, the latter for expelling castings from the dies.

After the die is placed in the holding frame of the casting machine, check castings are made which must be acclaimed perfect. It then goes into production. The casting machines consist of the frame for holding the die, a collapsible linkage for opening and closing the frame, a furnace and pot for holding the molten alloy, and a cylinder fitted with a plunger for forcing the metal into the die. Hydraulic pressure supplies the power for opening and closing the die, making the "shot," pulling the various slides or cores, and ejecting the casting. All these operations are often synchronized to make the casting cycle semi-automatic in operation.

Acceptable castings are forwarded to a cleaning department where excess fins are trimmed or filed off, and any necessary machining operations are performed.

Conveyor systems in the Doehler plant expedites the handling of all castings. Two operate between the casting and cleaning departments, one complete system for zinc and aluminum castings, respectively. Both systems consist of a double set of trays, one above the other; the lower tray carries raw castings from the machines to inspectors who remove gates and place them together with rejects on the proper one of three differently colored upper trays for delivery to the alloying department. Here a system of limit switches causes each upper tray to tip and empty its contents into the proper truck or alloy furnace.

The third conveyor system is similar to the other two, except that it has no upper tray. Factory boxes of finished castings or shipping cases of packed goods, if they are packed "in line", are placed on the trays at various points of the course which the conveyor takes through the zinc and aluminum cleaning and final inspection departments. The conveyor then delivers them for shipping.

Drawing Die Troubles

Specific faults in shells are traced to incorrect punch and die radii, poor blank-holder action, or other circumstances causing wrinkles or cracks

By C. W. HINMAN
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OTHER DEVICES for stripping the punch of drawn shells, in addition to those described previously (*AM*—Vol. 83, page 634), are probably not necessary. An extra stripping device will most often entail unnecessary cost. But for tools made on contract, or placed in production under an inefficient foreman or die setter, an extra stripper is an added precaution. It may prevent damage to the dies and eliminate the usual complaint that "the dies were not made right." On shells of thick material they are a necessity because the shell does not flare enough, at the top and around the punch, to resist shear when stripping under the die.

Another thing to bear in mind is that the angle of the flat surface of the die under the blank holder, Fig. 171, and the size of the radius leading into the die, control the drawing of the shell. When the angle is too obtuse, or the radius is too large, the shell will wrinkle. When the angle is too acute or the drawing radius is too small, the shell will rupture. A single-operation shell may be "ironed out" easier by the angle of the flat than by making a tight fit for the material between the punch and die. The pressure exerted by the blank holder, or pressure plate, is not positive and cannot be controlled accurately; therefore, it is best to vary the angle.

For any shell that is to be redrawn, the first drawing operation should not be ironed out. The proper way is to draw the shell without wrinkles, and to leave the ironing until the last operation. By this procedure, the dies will last longer, require less polishing, and there will be fewer stoppages for digging fractured shells from the dies.

It is important to establish the correct punch and die radii. For sheet metal from $\frac{1}{64}$ to $\frac{1}{32}$ in., inclusive, use a radius ten times the stock thickness. From $\frac{1}{32}$ to $\frac{3}{64}$ in., inclusive, use a radius six times the stock thickness. From $\frac{3}{64}$ to $\frac{5}{64}$ in., inclusive, use a radius four times the stock thickness.

Defects Cannot Be Corrected

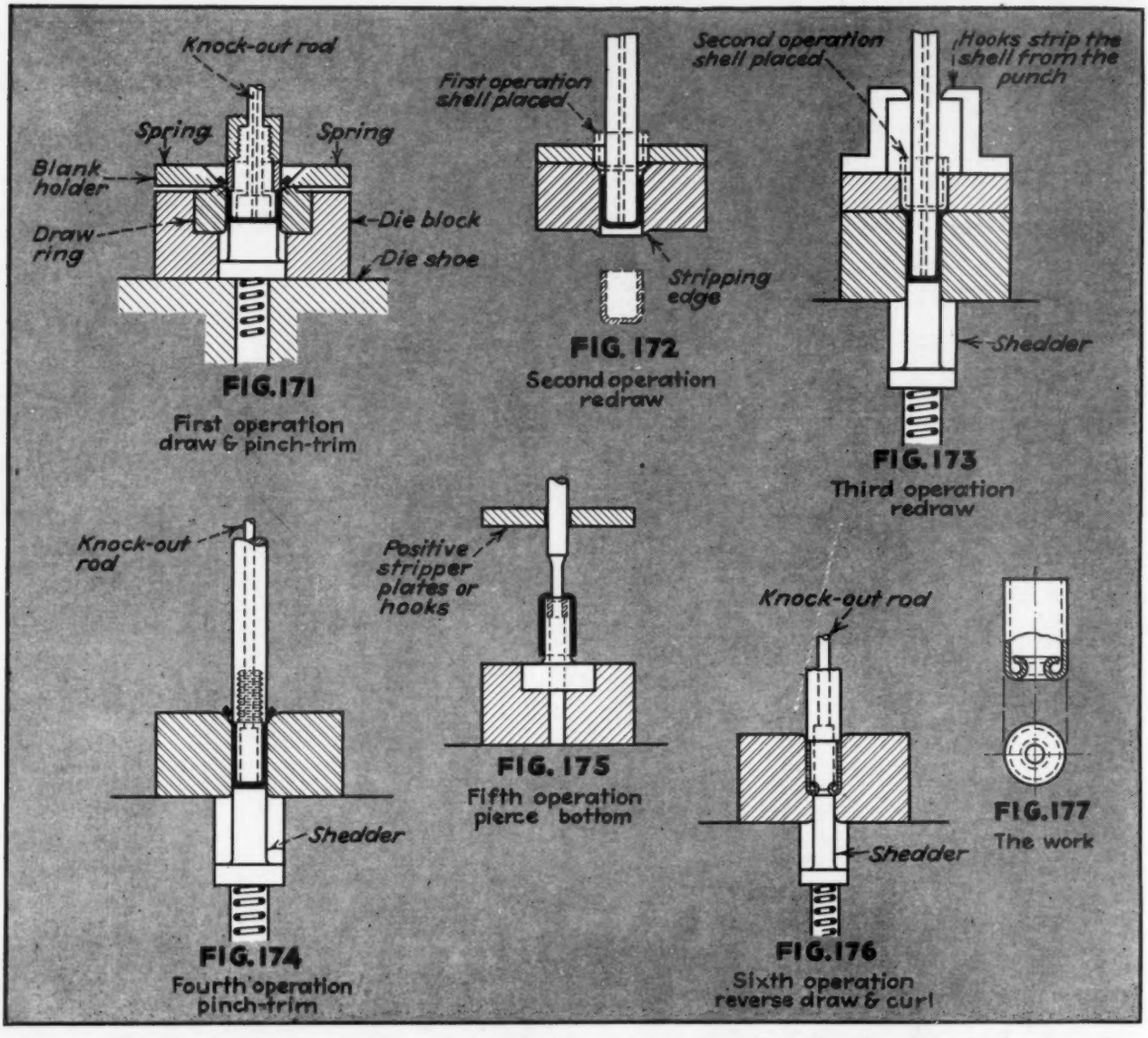
The next thing to remember is that a crack, wrinkle or thin place in the wall of the shell can never be ironed out. The first two may possibly be glossed or burnished over, but they are likely to show again at any time. The radius on the face end of the drawing punch should always be as large as possible to avoid trouble, especially in redrawing shells. A desirable condition is to make the bottom of the punch the same diameter as the final drawing operation, even though only the flat can be that diameter. Otherwise, corner ridges will appear on the sides of the shell, and much time and expense may be spent in trying to smooth out these marks.

That part of the blank between the outside diameter of the punch and the top of the die radius is not confined in any way. When the punch contracts the blank and starts down, this unsupported area is in tension. Instead of wrinkling like the rest of the blank, it has a tendency to stretch. The degree of stretching depends largely upon the tension on the rest of the blank, which in turn depends upon the compressive power of the blank holder. Whether this stretch takes place uniformly over the exposed surface, or at one point, depends upon the size of the radius around the lower end of the punch. A sharp-cornered punch will act as a blanking punch, and cut through the blank in spite of the die radius. A small radius will cause most of the thinning to be done just above the radius on the punch. Just how far the thinning at this point will go depends upon the resistance of the remainder of the blank to plastic flow. The resistance may be so great that the bottom of the shell will be punched out.

When a shell is redrawn the following conditions are present: The bottom is of original material thickness, but a part of it will be drawn up on the vertical sides of the shell. Immediately above it is a thinned ring of metal that will hug the redrawing punch and tend to accentuate the ridge caused by the thick metal of the bottom. If another redrawing operation is necessary, the ridge will obviously move up on the vertical surface, and another ridge, not so prominent perhaps, will show below it where the next corner turned. These ridges cannot be entirely removed. In any ironing operation that involves stretching, the thin part will stretch uniformly with the thick part. Even though it may be fairly invisible, the weakness still remains. On the other hand, the radius on the bottom of the punch must not be made too large because the unconfined metal along the radius may wrinkle. The hardest shell to draw is a semisphere, or one with considerable taper.

How to "Read A Shell"

If the bottom punches out at the beginning of the draw, the pressure pad should be released slightly. If it occurs half way down, the angle under the blank holder is probably too



Figs. 171–177—Six consecutive operations for producing a "curled-in" shell involve three steps in drawing, trimming, piercing and curling. Two different methods of stripping are required in these tools

abrupt. If further down, the reduction is too great for the grade of metal used, either because of "short" grain, not sufficiently annealed, or because the punch and die are too small in proportion to the size of the blank; in other words, too much of a reduction. If the cups fracture on one side, reset the die concentrically. If the side of the shell is burnished all the way down, and the bottom punches out, there is not sufficient clearance between the punch and die. If only the upper half of the shell is burnished, the clearance between the punch and die is about equal to the thickness of the original material.

If the outer surface of the shell has vertical scratches, the lip of the die, just below the radius, is becoming "loaded." The trouble is more than likely caused by too great a drawing speed. The cure may be more or better lubricant, a harder temper in the drawing ring, or finally slowing down the speed of the press ram. The first thing to do is to polish the radius inside the drawing ring. The same rule obtains here as with the punch; the polishing should be vertical and in the direction of the draw. Scale on annealed work will sometimes scrape off on the radius and wedge between the cup and the die, thus causing scratches.

Sometimes the metal used for drawing has such a high tensile or breaking strength, that it can be overworked without rupturing. In such cases, the shell may show a network of small cracks, which may break afterward. We might then lay it to aging cracks. The only remedy is to add a sizing operation.

If the shell comes out of the die with one side much higher than the other, the die may be pinching on one side, the stock may be thicker on one edge, or the blank holder may be pinching at one place. First turn the material over and see if the high place comes on the opposite side of the shell. If it does, the stock is at fault. If not, measure the walls and ascertain if one is thinner. If so, move the die in relation to the punch. Even then it may be the blank holder. So before shifting the die, it is better to test the tension between the die and the pressure plate with tissue paper. This test quickly determines whether the horizontal pressure is even all around the die, or if uneven, where and how much.

Figs. 171-176, inclusive, show the

six consecutive drawing die operations for producing the "curled-in" shell sketched in Fig. 177. This shell involves drawing, redrawing, trimming, piercing and curling.

The first operation, Fig. 171, shows the angle on the die surface under the pressure pad, the die drawing radius, and the open space between the punch side and the top of the die radius. For the second draw, the stripping edge is placed under the die, Fig. 172. The third drawing operation, Fig. 173, leaves the shell flared around the top for an even trim in the next operation. When the punch ascends, a shedder strips the shell from the die, and hooks strip the work from the punch.

A pinch-off trimming operation is next required, Fig. 174. The shell is ejected from the die by a shedder and from the punch with a knock-out rod. Piercing a round hole in the bottom of the shell is done in Fig. 175. The shell is carried up with the punch ascent, and is stripped off against a positive plate, or hooks can be used. The final operation is reverse drawing and curling. This operation is finished and spanked to size at the maximum down stroke of the punch, Fig. 176.

Part 28 of Mr. Hinman's series will appear in an early number.

Metal Cleaning Hints

By JOHN E. HYLER

A good job of finishing on metal parts cannot be obtained unless proper cleaning methods have been employed. These must be such as to insure that the material will be free from oil or grease with which it has become coated during machining operations. Any other foreign accumulations on the metal surfaces also must be removed entirely in order that the lacquer, enamel or other finishing material can obtain a proper bond with the surfaces.

There are certain factors which go a long way toward insuring success in proper cleaning; and there are other factors which will cause trouble. It goes without saying that a proper type of cleaning solution must be used, and it also is easy to understand that the material used for cleaning must itself be removed before the metal surfaces are ready for finishing operations.

Gradual adulteration of rinsing water with the cleaning solution is a matter that should be watched with care. A small amount of the cleaning solution inevitably is carried along when a charge is lifted from the cleaning solution and immersed in the rinsing bath. There is a story of a peddler who went out to sell cottage cheese and apple butter, having a large container of each in his truck. He had but one ladle to measure the material. By the time he had made a half-dozen sales, there were brown streaks in the cottage cheese, and white ones in the apple butter. By the time he had gone ten blocks down the city street, he no longer was sure which was cheese and which was apple butter. The same things happen to a rinsing bath that is kept in service too long, but there is not the difference in color to warn of approaching trouble.

Some have found it advantageous to use a double rinsing bath. The material is brought from the cleaning solution and rinsed in the first water, which is best kept near the boiling point. When it is raised from this rinse it is dipped into the second one, which remains relatively clean and removes the last trace of the cleaning solution. Even with such a provision, it is well to determine a time or production quantity period, whichever may seem most convenient, at which the rinsing water will be replaced. If it can be arranged conveniently, it will be economical at such a dumping time to let original rinse number two become number one. Thus, only the badly contaminated water will be dumped out at each change.

Just as there is danger of adulterating the rinsing water sufficiently that traces of the cleaning solution will be left on the work, so it is possible that the cleaning solution may be diluted. This has been experienced by some who have heated their cleaning solution by feeding live steam into the tank. Condensation continually added to the contents of the tank can only dilute the solution. If it is desirable to heat solution tanks with steam, it should be by means of steam coils which introduce no condensation.

While steam coils can be made to do a fair job of tank heating, perhaps the most satisfactory way to heat a tank of cleaning solution is to use electric heating units designed for such service. Electric immersion heaters arranged with thermostatic control not only insure that the strength of the solution will remain substantially the same over a considerable period of time, but they also insure that the temperature will be held evenly. Like the rinsing bath, the cleaning solution is best kept close to the boiling point.

A cleaning solution in a state of relative quiescence will not clean as efficiently as when it is agitated. There usually is some attempt to agitate the solution to some extent. The heating units are kept close to the sides of the tank so as to leave the center unobstructed for dipping, and the same principle must be observed in the use of any device to produce agitation. Some have made use of a baffle plate along one side of the tank, closed over the top, with the heating units behind it. The only escape for the heated fluid from the baffle chamber into the tank proper is through a series of holes. The solution becomes hot behind the baffle, and it must go upward. It is forced out through the holes with a jet-like action which keeps the tank contents in continual motion.

Another means which may be employed to promote agitation of tank solutions is the admission of compressed air. In order to do this, one or more pipes having a series of small holes are run across the tank, and air is admitted to these pipes. The holes are positioned in such a manner as to offer maximum agitation with the least air. Failure will result, so far as uniformity is concerned, if the holes are made too large for the quantity of air admitted to the pipes, because practically all of the air will escape from the first few holes of the series under such circumstances.

While cleaning tanks have wide use, there are many cases in which a continuous cleaning machine will give more advantageous service. These machines usually are conveyorized and often arranged for automatic handling of the material. Some of them employ the liquid immersion principle, very much the same as that of the open-top cleaning tank, but others use a vapor process and some use a hot spray of solvent. It is possible to incorporate in a given cleaning machine any particular combination of these three processes that may seem best adopted to a given cleaning problem.

IDEAS FROM PRACTICAL MEN

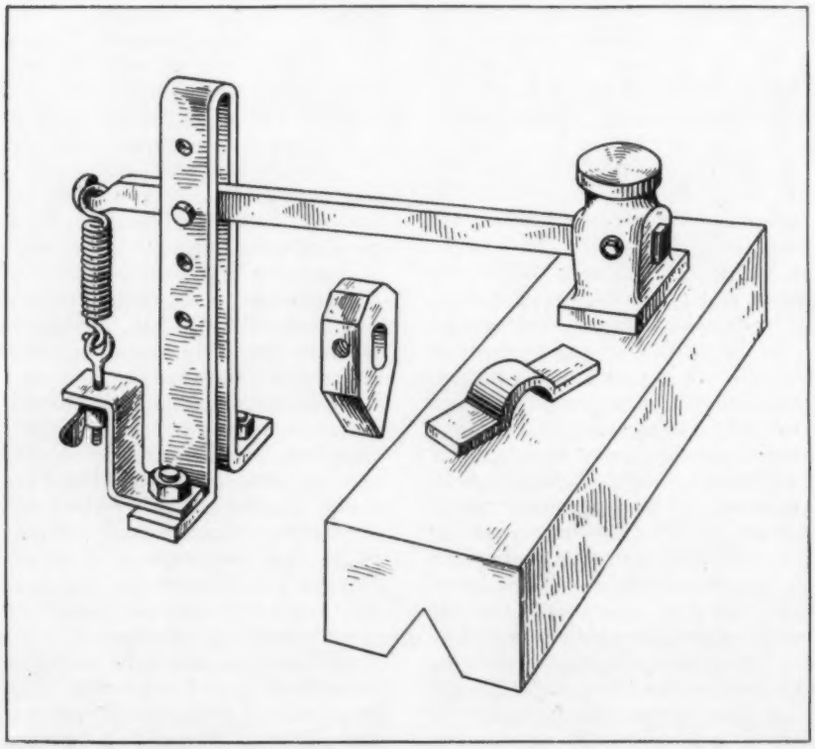
Small Bench Hammer

By CHARLES H. WILLEY
Superintendent of Manufacturing, Hoyt Electrical Instrument Works

In straightening, flattening, forming and cutting off work on the bench, the workman often wishes he had a third hand; one for holding the work; one for holding the tool and one for using his hammer.

The small bench hammer illustrated takes the place of the workman's third hand. It is just a small helve hammer in which means are provided for holding the various tools required for different operations. The handle is normally held up by a spring, holding the tool up from the anvil and leaving its surface clear for locating the work.

After the work has been properly positioned for the operation, the workman holds it with one hand while he uses the other to strike the tool held by the helve with his hand hammer. After each blow the spring raises the tool from the anvil. The helve can be adjusted to hold the tool at the proper height to suit the work by a pin through it and through the upright at the rear.

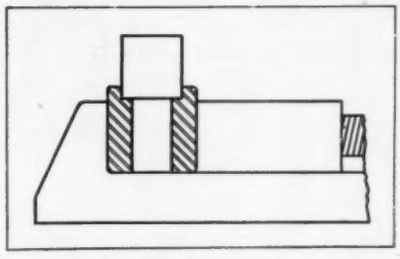


The workman holds the work in position with one hand and uses the other to strike the tool on the hammer handle

Simple Parallel Separators

By ROBERT KNOTEK

In drilling through work held in a machine vise, parallels are frequenlty used to support the work and to prevent the drill from coming through and injuring the vise. Where the diameter of the drilled hole is almost as large as the width of the work, very thin parallels can be kept against the vise jaws by paper wads as described by C. W. Anderson (*AM*—Vol. 83, page 89). To eliminate the use of such parallels, I ground a recess in each of the jaws of the drill-press vise, leaving a ledge in each jaw for the work to rest on, as shown in the sketch. Care was taken to have the ledges the same distance from the bottom of the jaws.



A recess ground in each of the jaws of a machine vise, leaves ledges to support the work to be drilled and eliminates the use of thin parallels

By MATHEW HARRIS

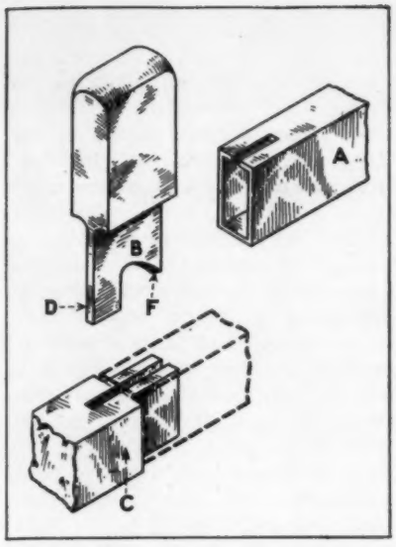
If Mr. Anderson would smear the surfaces of the thin parallels next to the vise jaws with a little heavy machine oil or very light cup grease, they would stick to the jaws and there would be no need for rolls or wads of paper to keep them in place.

Hand-Operated Punch and Die

By L. KASPER

A number of pieces of rectangular brass tubing were to be slotted at both ends of the same wall. The work was formerly done in a milling machine, but since it was ordered in various lengths and a few at a time, the time of setting up the machine for the job and its loss of use from other important work became a factor worth considering. To meet these conditions the hand-operated punch and die illustrated were made at small cost.

Referring to the illustration, *A* is the work, *B* is the punch and *C* is the die, the work in place being indicated by heavy dashed lines. One end of the die is reduced and is entered into the work slightly farther than the required length of the cut and governs the length of the slot. The opening in the die extends beyond the work and permits the use of the pilot *D* on



For slotting small lots of tubes at infrequent intervals, these hand-operated tools prevent interrupting the work in a busy milling machine

the punch which enters the die beyond the shoulder and serves as a guide to align the punch with the die.

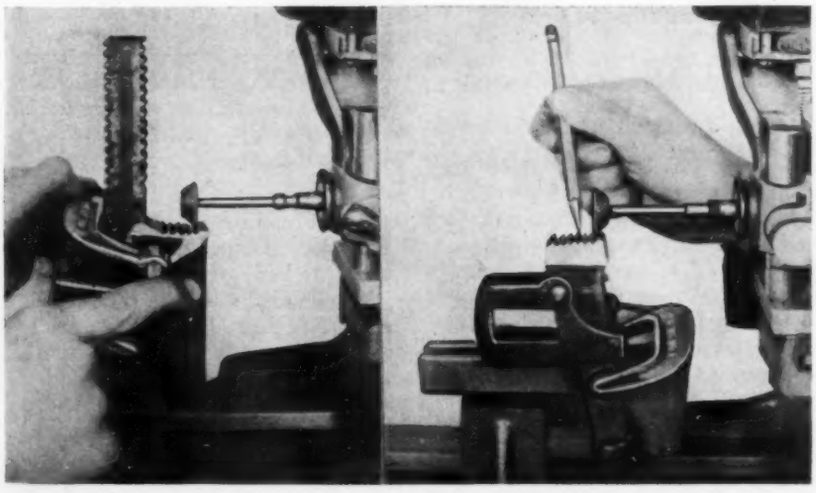
A sharp blow on the punch with a hammer drives it through the wall of the tube, the keen edge *F*, starting the cut at the required distance from the end.

Reconditioning Pipe Wrenches

By ARMEN TASLYIAN

We recently reconditioned several dozen pipe wrenches of the stillson type by recutting the teeth in the jaws by grinding. The work was done in the lathe by the use of an electric toolpost grinder having a vertical feed adjustment and equipped with a 60 K alundum wheel having the same angle as that of the original teeth in the jaws.

The jaws were clamped to upright members strapped to the lathe bed, as shown in the illustration. The original spacing of the teeth was duplicated by movement of the carriage, the wheel was fed across the jaws by the cross-feed screw, and the depth of cut was controlled by the vertical adjustment of the grinder. The set-up for recutting the teeth in the movable jaw is shown at the left, while that for the stationary jaw is shown at the right.



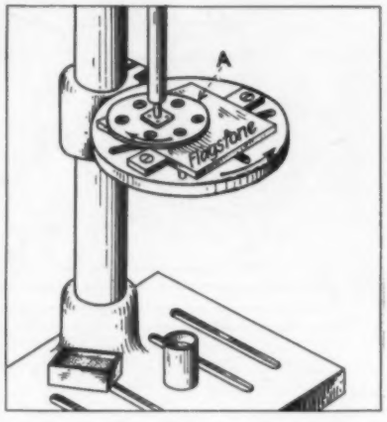
Pipe-wrench teeth were recut by grinding, using an electric toolpost grinder equipped with a wheel of the same angle as that of the original teeth

New Use for an Old Drill Press

By GEORGE BLUM

During 50 years of service, some of the marble floor stones in the administration building of a state institution became so badly worn that resurfacing was necessary. Due to the presence of immovable fixtures and inaccessible corners, resurfacing could not be done with the stones in place, and even if that were possible, removing the necessary amount of material would have left them out of level with the rest of the floor. So it was decided to take them up for resurfacing.

An old drill press was rigged up as shown in the illustration. The grinding disk *A* was wood, 2 in. thick and 12 in. in diameter, and had a sheet-metal grinding face. It was attached to a 4 x 4-in. plate that was keyed to an old drill shank. Sand, mixed with water, was used as the abrasive. To insure uniform grinding, the table was unclamped and left free to revolve and was set off center with the spindle. The stones were clamped off center of the table, resulting in the table being slowly revolved by the grinding friction and in a direction counter to that of the disk. To polish the stones, the spindle speed of the drill press was increased and the sand



Worn marble stones were taken up and ground in an old drill press, using coarse sand mixed with water as an abrasive

was replaced by rock dust, making a fair polish. While more than 1,000 stones were salvaged by this method, while six were broken. In replacing the stones, sufficient grout was placed to bring them up to the floor level.

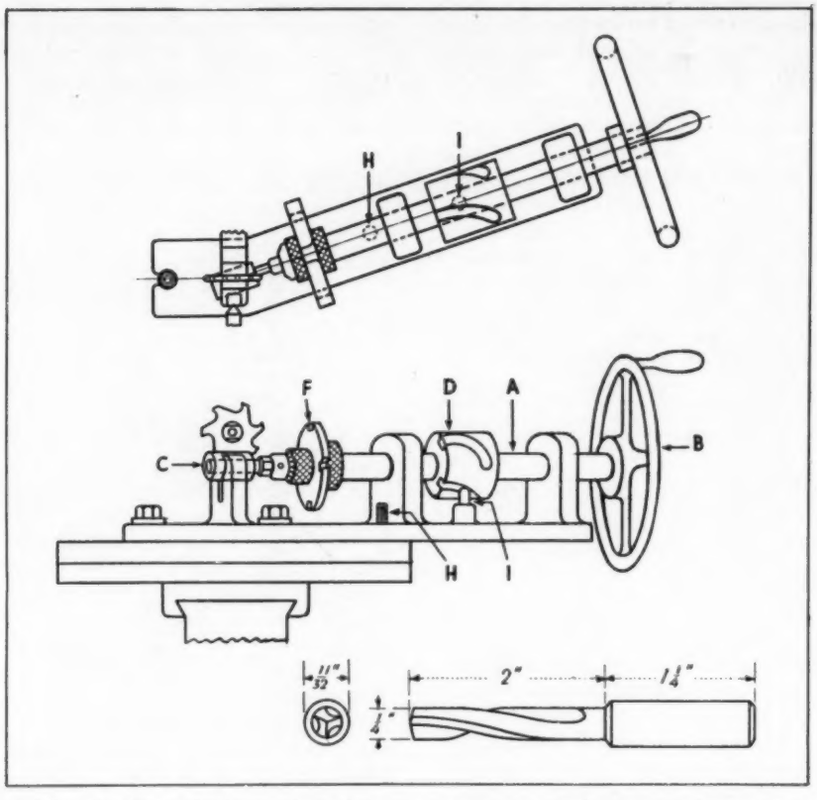
Inexpensive Fixture for Fluting Twist Drills

By HERBERT M. DARLING
Superintendent, Wells Tool Company

A small shop took an order for a large quantity of short three-fluted twist drills to be used in an electric hammer for drilling masonry. The only milling equipment the shop had was an antiquated hand miller, on which the fixture illustrated was mounted for the job.

The machine table is clamped so that it cannot move, all feeding and indexing being done by sliding and turning the spindle *A* by the handwheel *B*. The drill blank is held in a Jacobs chuck and is fed through the bushing *C* which has an opening to admit the cutter. The lead cam *D* has three helical grooves and is attached to the spindle. The disk *F* for operating the chuck has four notches in its periphery and is shrunk on the knurled sleeve of the chuck.

In operation, the knee of the machine is raised until the cutter enters



While this fixture lacks much of being the last word in fluting equipment, it is doing a good job in a shop where ingenuity is often required

the bushing to the required depth. The spindle is then pulled back and turned until one of the notches in disk *F* is engaged by the pin *H*. The chuck is opened by turning the handwheel to the left, a drill blank is inserted and the chuck is closed by turning the handwheel to the right. The spindle is then pushed forward and turned so that one of the grooves in the cam is engaged by the stationary index pin *I*. Turning the handwheel to the right then causes the cam to move the spindle forward, bring the end of the drill blank into the bushing and against the cutter. Continued turning the handwheel to the right causes the blank to be fed to the cutter, rotating as it advances, milling the first flute. Pulling the spindle back until the groove in the cam clears the index pin and then pushing it forward and rotating it engages the index pin in the next groove of the cam. The forward feeding is then repeated, milling the second flute in the blank. The third flute is milled in the same manner.

When all the flutes have been milled, the spindle is pulled back and rotated until pin *H* engages one of the notches in disk *F*, when a twist of the handwheel to the left opens the chuck. The completed drill is then removed, another blank is inserted in the chuck, the chuck is closed by turning the handwheel to the right and the operations for milling the flutes in the previous blank are repeated.

The flutes in the drills are neither ground nor polished, the roughness caused by fast feeding being of no importance. The machine operater flutes about 100 drills per hour, although he has fluted as many as 170 in that time. The material is a tough chisel steel and the high-speed cutter is run at 175 r.p.m. Cutting oil is supplied from a drip can.

Aids for Hand Stamping

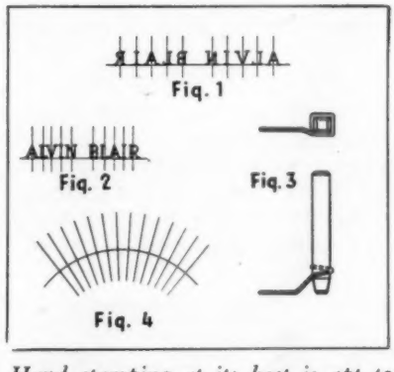
By MARTIN H. BALL

Many machinists who have to stamp work experience more or less difficulty in keeping the letters in good alignment and properly spacing them, as well as locating the stamping central in the space allotted to it and in a location on the article to be stamped that would add to rather than detract from the general appearance. Different styles of letters require different spacing to make them look well, and a good way to determine the spacing is to lay the stamps down with their faces in view in the order in which they are to be used, as in Fig. 1.

The name ALVIN BLAIR has been selected to illustrate the most prominent variations in spacing, as in Fig. 2. It is obvious that the uniform center distance shown in the stamp line in Fig. 1 is not the best. It is also obvious that the space between the letters *L* and *V* should be reduced on account of the sloping side of one being adjacent to the open side of the other presenting an appearance of greater spacing than really exists. The same appearance exists to a lesser degree between *A* and *I*, where one of the letters presents a sloping side to the vertical side of the other. Letters having rounded sides should also have some adjustment. No fixed rule can be laid down for these variations since the style of the letters used requires different spacing.

It is usually most satisfactory to make a freehand layout on the article to be stamped, showing a line for the bottoms of the letters and the vertical center line for each letter. Such a layout can be made with a lead pencil.

The indicator guide finger shown in Fig. 3, placed over the line of layout through the bottom cut of a letter and central with the vertical line of the letter to be stamped will aid in spacing. It is made from spring wire from 0.015 to 0.025 in. in diameter, in proportion to the size of the letter to be stamped, and is a friction fit on the body of the stamp.



Hand stamping at its best is apt to be sloppy in spacing and alignment of letters unless aided by some such means as described.

When radial stamping is desired, a radial line is laid out and angular lines are drawn for the letter centers, using the same process as previously described. A form of such a layout is shown in Fig. 4. It is better to extend the vertical or angular lines both above and below the line of lettering, as sometimes it is more easily seen above and at others below when setting the stamp for striking.

Surface Hardening Steel Parts

SEVEN WAYS of increasing the hardness of the surface of steel parts by heat-treatment may be grouped under two general headings, depending on the type of change in the surface:

1. Adding elements to the material at the surface.
   - Carburizing (adds C)
   - Nitriding (adds N)
   - Cyaniding (adds both C and N)
   - Ihrigizing (adds up to 14 per cent Silicon)
2. Changing character of material at the surface.
   - Flame hardening
   - Induction hardening

The selection of a possible surface-hardening method will depend upon the depth of case desired, the number of parts to be treated, the types of steel to be treated, the type of furnace available, the operation subsequent to the heat-treatment, allowable production time, and service use.

Carbon below 0.15 gives high ductility, good shock resistant qualities, but low case strength and poor machinability. Carbon between 0.15 and 0.25 gives a trifle less ductility, but more machinability.

While it is generally accepted that 0.25 is about the maximum amount of carbon allowable in a carburizing steel, this amount may be exceeded. Generally, carburizing is intended to give a hard surface with a ductile and tough core. However, if the ductility or the toughness of the core is not important and hardness is still more important, the carbon content can be increased to as much as 50 points and the carburization process itself will be entirely satisfactory. The overall strength characteristics will, of course, be much different particularly under impact loads or notch effects.

To secure maximum case hardness the carbon steels require drastic cooling mediums. This would cause distortion in thin sections and in intricate shapes. Drastic cooling causes a brittle case and combined with the relatively weak core gives less overall strength than is possible with alloy steels.

Alloy steels have a lower critical cooling rate which makes for greater hardenability with the commercial processes. They can be oil quenched. The case and core are tougher than for the carbon steels. Annealing and working difficulties, however, increase with the increase in alloy content. A rule of thumb is that the total alloy content should not exceed five or six per cent. High cost and more expensive heat-treatment requirements often eliminate steels of high alloy content from consideration unless high physical properties are required.

Steels having grain sizes from five to eight are the ones most commonly used for carburizing. Almost any of the steels can now be secured in fine grain size. This gives a steel which will not become coarse at carburizing temperatures, the direct quench will give a tough product and, since they are shallow hardening, there is less distortion. They do not machine as readily as coarse-grain steels unless normalized at high temperatures. Even then the normalizing temperature is sometimes not sufficiently effective to make some steels as readily machinable as desired. The coarser grained steels are tougher, distort more but harden and work more readily.

The relative rapidity with which a certain case depth can be reached can only be determined approximately. Tests at 1,600 F. after four hours have shown 0.03 in. depth for methane gas, 0.06 in. for Ihrigizing, and 0.030–0.040 in. for activated cyanides. The variations in steel, furnace controls and compounds are some of the factors which will give a different answer in each shop.

Localized Hardening

Localized hardening is used to secure good wearing qualities on parts of materials which heretofore could not be hardened except with difficulty or expensively (because of small quantity, extreme size or non-case-hardening materials). The surface of the steel is hardened by heating the steel locally to critical or hardening temperature and quenching.

Flame hardening is flexible, rapid and adaptable. Generally speaking, it is particularly suited to steels in the medium-carbon range where the greatest per cent increase in hardening ability is obtainable. For carbon content of less than 0.35 per cent an increase in manganese is desirable. No alloy steels of carbon as low as 0.25 per cent and containing 0.50 to 2.00 per cent of chromium, manganese, nickel and silicon may be flame-hardened. With a moderately rapid quench, a Brinell of 500 is attainable. High-carbon steels, particularly in the tool-steel range, are apt to spall or crack when heating is too rapid or the quench is too severe.

Hardening by means of electric current is a quick process for securing good wear surfaces. Held in special devices, bearing surfaces are heated by induced electric current to about 1,600 F. or until the critical temperature of the metal is reached. This is a matter of only a few seconds after which the parts are immediately quenched with water giving a hard long-life surface with the desired tough core. The process has been worked out for the hardening of bearing surfaces on crankshafts, camshafts and other parts in mass-production quantities. Small quantities can be induction surface hardened by hand.

Steels treated by this process should be fine grained but the process permits the substitution of cheaper steels for more expensive high alloy steels where service conditions warrant it. S.A.E. 4340 is one of the higher alloy steels successfully hardened by this method. The table lists others which have been successfully handled in production.

The table summarizes the primary points involved in the selection of a method of surface hardening steel parts. It is intended as a convenient and approximate reference only, and more complete details should be secured from manufacturers of the materials in question.

We wish to acknowledge the assistance of the following companies in addition to those whose products or processes are mentioned: Air Reduction Sales Company; G. S. Rogers & Company; Hafleigh & Company; Hoskins Mfg. Co.; Leeds & Northrup Company; Linde Air Products Company; Rogers & Hubbard Company; Strong, Carlisle & Hammond Co.; Globe Steel Tubes Company.

AMERICAN MACHINIST REFERENCE BOOK SHEET

SUMMARY OF SURFACE-HARDENING METHODS

Method	Process	Type of Case	Brinell Hardness	Materials	Advantages and Applications	Materials or Trade Names
Pack.....	Carburizing	C	650–700	S. A. E. steels: Carbon — X1015, X1020, 1010, 1015, 1020, 1025, 1315. Ni[1] — 2015, 2115, 2315, 2320, 2330*, 2513. Ni-Cr[2] — 3115, 3120, 3125*, 3215, 3220, 3230*, 3312, 3325*, 3415. Cr-Mo[3] — 4120. Ni-Cr-Mo — 4320. Ni-Mo — 4615. 4620, 4815, 4820. Cr — 5120. Cr-Va — 6115, 6120, 6125*.	Applicable to any part of normal size and of proper carburizing material where absolute uniformity of case is not essential. Usually used for case depths greater than 0.015–0.020 in. because variation in depth becomes less important with thicke cases. This method gives the deepest case of all methods except gas carburizing, and is adaptable to many kinds of furnaces, including continuous type and special containers.	Charcoal or coke plus energizers, bone, hydrocarbonated, bone black, and others.
Liquid...	Carburizing	C	700	See pack carburizing	Applicable to sizes that can be processed in a liquid bath where uniformity of case is desirable with low distortion. This is a quick and economical method of obtaining a thin carbon case (up to 0.04 in.).	"Perliton" is claimed to give a pure carbon case.
	Nitriding	N	700–1000†	Nitralloys — 135G, 125H, N, 230, 135 (modified) (C, 0.25–0.35; Mn, 0.40–0.60; Cr, 1.40–1.48; Mo, 0.30–0.45; Al, 0.75–1.30). Some high-speed and other alloy steels.	Applicable to any part that can be handled economically in a bath where a thin hard case consisting primarily of nitrides is desired. Gives a hard but thinner case more quickly and economically than gas nitriding. Low temperature operation gives low distortion.	Chapmanizing and R&H Special Nitriding Bath.
	Cyaniding	C+N	680	See pack carburizing	Applicable to small or medium size parts requiring case depths of 0.003 to 0.040 in., although used primarily for case depths of 0.010 to 0.015 in. and where close control of case depth is desired. This method is rapid, and provides a uniform case depth with small amount of distortion; particularly desirable for thin parts.	Aerocase, Aerocarb, Du Pont Carburizing Salt, Hard Case, Light Case, Lavite CH, Parkase, Valcase. Also sodium cyanides with or without activators.
Gas.....	Carburizing	C	650	See pack carburizing	Applicable to a wide variety of sizes of parts and furnaces. Particularly useful for mass production of parts requiring medium to heavy cases since it eliminates packing and handling required for pack carburizing. This method gives a uniform depth of case with controlled carbon content in less time than pack carburizing. Scale can be controlled. Parts can be quenched direct from the furnace.	Methane, butane, propane, natural gas, city gas, liquified hydrocarbons, Carbonal and Vapcarb.
	Nitriding	N	1100†	Nitralloys	Applicable to parts requiring good wear properties with a thin case, such as engine cylinders, wearing parts in diesel-engine injectors, pump shafts. This method gives the hardest of all surfaces, while the low temperature of the process minimizes distortion.	Ammonia gas.
	Cyaniding	C+N	680	See pack carburizing	Applicable to any part, depending on available furnace, material or design. This method gives a medium-hard uniform case at temperatures as low as 1,150 F. Parts come out clean with little or no distortion. Any combination of carbon and nitrogen can be achieved in the case.	Ammonia gas plus hydrocarbon gas; Dry Cyaniding; and Ni-Carbing.
	Ihrigizing[4]	Si	175	S. A. E. steels — 1010, 1015, 1020, 1025, 1030, 1035, 1040, 1045, 1050, 1095. Cast steels with sulphur content lower than 0.05 per cent and chromium less than 0.20 per cent.	Applicable to any size or shape of part (except too thin sections) where it is satisfactory to have a case which is not "hard" to a penetration-type tester but cannot be cut or machined by ordinary methods. This method produces a high silicon content case of 0.005 to 0.100 in. depth at a rate of about 0.015 in. per hr. with good wearing properties plus resistance to corrosion at operating temperatures up to 1,800 F. The case is claimed to have the property of absorbing oil, giving it a self-lubricating quality.	Silicon carbide plus chlorine gas.
Flame.....	Local hardening	....	400–650	S. A. E. steels: Carbon — 1035, 1040, 1045, 1050, X1340. Ni — 2335, 2345. Ni-Cr — 3135, 3140, 3145, 3150, 3240, 3250, 3325, 3335, 3340, 3435. Cr-Mo — 4130, 4140, 4150. Ni-Cr-Mo — 4340. Ni-Mo — 4630, 4640, 4650. Cr — 5140, 5150. Cr-Va — 6135, 6140, 6145, 6150.	Applicable to hardening bearing areas on machine tool ways, large gears, shafts, pads on spindles, and other large or medium-size carbon or alloy-steel parts where carburizing or other hardening methods would be impractical and controlled depths of 0.0625–0.25 in. are desired. Used on spiral, bevel, and hypoid gears and pinions; if quality and type warrant it, gears of 10 D.P. and finer can be treated. Distortion is reduced because heating is localized.	"Shortorizing" is one term applied when torch and quench are mechanically actuated; Farrel-Birmingham and Gleason machines for hardening gear teeth.
Induction	Local hardening	....	625–680	Same as for "Flame" plus S. A. E. steels — 1350, 1360, 2330, 2350, 3130, 3245, 3450, 52100, 6195.	Crankshafts, camshafts and other shafting with multiple bearing areas were first handled by this method. Small parts in business machines have been hardened by this method, using special form jigs. This method gives local selective hardening of surfaces too difficult to handle by other processes and does so fast enough for mass-production requirements.	Tocco and Ajax-Northrup.

* The core will respond to quench giving poor ductility when the carbon content is more than 0.25 per cent. Carbon content up to 0.50 per cent may be used if core properties of toughness and softness can be sacrificed in design.

† Monotron.

[1] Nickel steels for case-hardening may contain 1.25 to 5.0 per cent nickel. It lowers quenching temperatures, thus minimizing distortion and scaling.

[2] Chromium steels excellent for case-hardening. Like nickel and molybdenum it contributes to grain refinement.

[3] Molybdenum in steels contributes to strength and grain structure. When used in carburized gears, low distortion in direct quenching is a feature.

[4] The higher carbon, low sulphur steels can be treated satisfactorily but are impregnated more slowly, S. A. E. 1045 requiring about twice the time of S. A. E. 1015 for the same case depth.

Ford Raises an Issue

THE FREE speech clause of the Bill of Rights is dead insofar as labor unions are concerned. That, in effect, is what the National Labor Relations Board has told Henry Ford.

Labor agitators have swarmed into Dearborn, denounced Ford and his policies, and urged his workers to gang up against him. Mr. Ford has refused to take it lying down. He told his people exactly what he thought of the intruders. In doing so he exercised no more than his inalienable right as an American citizen to say what he thinks.

But the Labor Board ruled otherwise. They said he violates the law when he condemns the acts of labor agitators no matter what those same agitators may say about him. So it is only natural that Mr. Ford, fearing no man or government agency (remember N. R. A.?), should now be standing on his legal right as a citizen to say what he thinks about unions or, for that matter, about anything else.

One hundred and fifty years before anyone knew what the initials N.L.R.B. stood for, Congress adopted a Bill of Rights, Article I of which says, "Congress shall make no law . . . . abridging the freedom of speech". Just where does that leave the Labor Board except out on a limb? That is what Mr. Ford is asking the courts to decide.

Two other phases of the situation are worth examining. The Communist Party, every other political party and every group advocating an "ism" has the right to meet openly in the United States and, barring sedition, say what it pleases about anything and everything. And that is as it should be.

If the shoe were on the other foot, if a reactionary Washington administration, out of sympathy with organized labor, permitted employers to denounce unions while telling labor leaders to remain silent, there would be a cry of protest. The Civil Liberties Union would dig deep into its pockets to defend the unions inalienable rights. Right now the Civil Liberties Union would do well to examine the denial of Mr. Ford's rights as an American citizen.

The function of a government board should be to support, rather than to deny, the right of both sides to express their views freely and publicly. The failure of the Labor Board to do so again emphasizes the onesided phases of the Wagner Act. It gives the Congressional committee, now investigating the operation of the Act, further evidence on the unsoundness of parts of the legislation that has only served to promote discord between employers and employees.

Burnham Finney

GAGING BUSINESS

Metal-working industry seeks to appraise the effect of a war in Europe. Greater activity anticipated in any event.

Herr Hitler's hand has been felt in domestic as well as foreign business for the past two weeks. Events preliminary to the seizure of Danzig created a lull before the storm. As we go to press, incidents abroad point toward war. But war or peace business will move ahead—either to the feverish activity that Mars inevitably demands or to the less hectic but more stable level indicated during those intervals when peace seemed a possibility. For the moment, trade is stunned along with all human sensibilities; but there is work to be done.

MACHINE TOOLS—A slight hesitcnay in order placing is attributed to the show next month. While machine tool users want a look at the new designs before placing their business, this condition does not reflect any slackening in ultimate demand. Deliveries have lengthened, and in most quarters, inquiries are plentiful. Government buying continues at a high level. Recent army and navy orders have gone to Brown & Sharpe, Hardinge Bros., Cincinnati Milling Machine and Cincinnati Grinders, Inc., Kearney & Trecker, Pratt & Whitney, and Warner & Swasey. The foreign situation is, of course, chaotic and will temporarily cut into high percentage of overseas machine tool sales.

AUTOMOBILES—Factory sales of 1940 passenger cars in the United States and Canada are expected to be 20 per cent ahead of last year. Some major producers are late in getting new models started, so it would be surprising to see more than 1,000,000 cars assembled in the last four months of 1939. Larger surfaces on 1940 auto bodies call for more sheet steel—one maker is using an additional 17 sq. ft. Parts plants look for a more profitable fourth quarter, but some fear a renewal of labor trouble.

STEEL—Production continues above 60 per cent capacity with indications that it continue at present levels or better. Scrap prices are again rising. Detroit's demand for its new auto models is a major sustaining influence, but miscellaneous orders have been coming in from unexpected sources.

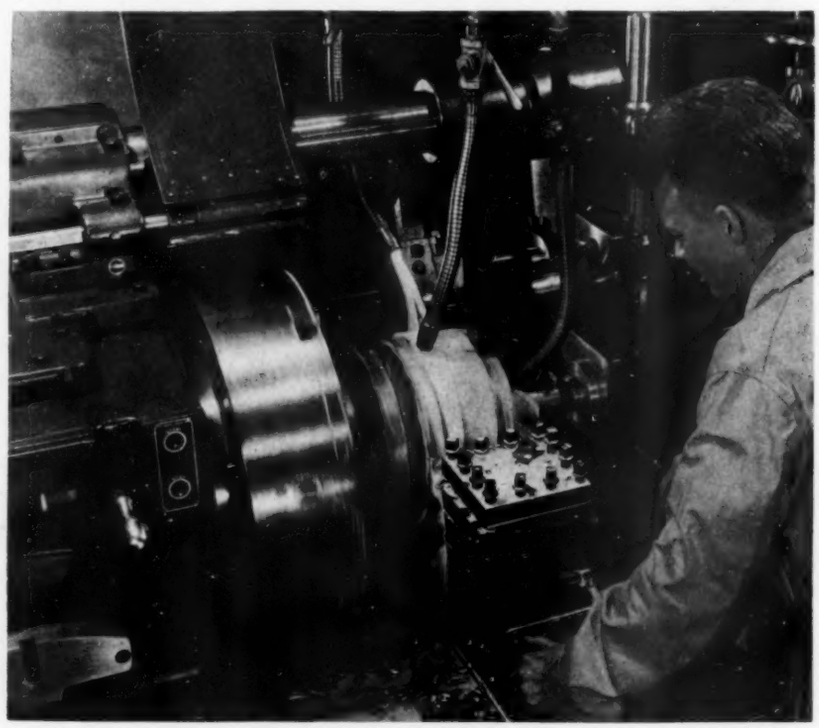
RAILROAD EQUIPMENT—August railroad traffic was up 11 per cent above last year and recent indications are for a better than seasonal increase. While rail equipment manufacturing is in the trough of its cycle, improvement is sure to come. As a result of heavy retirements freight car and locomotive ownership has dropped since 1937. Given higher traffic requirements the roads would need new equipment. Recent indications are orders by Chesapeake & Ohio for 2,500 new 50-ton freight cars. Pittsburgh Railway has authorized the purchase of 100 streamline cars from the St. Louis Car Co., with motors and controls by Westinghouse. Missouri Pacific is to spend about $3,000,000 for 1,000 freight cars, two streamlined trains, two diesel-electric passenger locomotives and seven diesel-electric switching locomotives. Southern Railway will place $400,000 in orders for new passenger equipment. Norfolk Southern R. R. has asked permission to borrow $607,000 to purchase five locomotives and equipment. Pullman Standard has received orders for 49 ore cars from the Tennessee Coal Iron & R. R. Co.

FARM IMPLEMENTS — Business this year in both farm implements and tractors will not total anything like 1938 sales. There is some activity in corn-picking machinery. Continued development of new and lighter weight farm equipment will increase interest in this direction, but much of it is in the lower price brackets. A lower farm income has been a deterring influence.

AIRCRAFT—Activity continues at a high level. Boeing Airplane has the highest backlog in history—orders for $21,000,000 with 3,800 employees. Recent large government orders went to Grumman Aircraft ($1,786,860) and Pioneer Instrument ($131,775).

FOOD MACHINERY — Manufacturers in this line have enjoyed about the same increase over last year as other machine makers. Canning machinery has not fared as well as average because of a carryover of last year's surpluses. A seasonal pickup is ahead for dairy, bakery and confectionery machinery makers.

Setting the Stage—*Machine tool builders note slight preshow hesitancy but look to the coming Cleveland exhibition of their products to improve the ratio of domestic to foreign sales*



NEWS OF THE INDUSTRY

MANY GROUPS PLAN MEETINGS AT MACHINE TOOL CONGRESS

CLEVELAND—With time at the Machine Tool Show at a premium, every effort has been made to squeeze the most activities into the shortest possible time in the Machine Tool Congress to be held Oct. 4–12. Present program calls for meetings on the following dates:

Wednesday, Oct. 4

National Electric Manufacturers Association, Hotel Cleveland ballroom, 8:00 p.m.

Thursday, Oct. 5

American Society of Mechanical Engineers, Machine Shop Practice Div., Hotel Cleveland ballroom, 8:00 p.m.

American Society of Tool Engineers, Cleveland Engineering Society quarters, Guildhall, 8:00 p.m.

General Electric Institute, open house program and lighting demonstration, Nela Park, 7:30 to 10:00 p.m.

Friday, Oct. 6

American Society of Tool Engineers, dinner meeting, Hotel Statler ballroom, 6:30 p.m.

National Association of Foremen, Music Hall, Cleveland Public Auditorium, 8:00 p.m.

Monday, Oct. 9

American Foundrymen's Association, dinner meeting, Hotel Hollenden ballroom, 6:30 p.m. Symposium on castings, Hotel Hollenden ballroom, 8:00 p.m.

Associated Machine Tool Dealers of America, dinner meeting, Hotel Cleveland ballroom, 6:30 p.m.

Tuesday, Oct. 10

Cleveland Engineering Society, Machine Design Div., Music Hall, Cleveland Public Auditorium, 8:00 p.m.

Wednesday, Oct. 11

Society of Automotive Engineers, dinner meeting, Hotel Cleveland ballroom, 6:30 p.m.

Thursday, Oct. 12

General Electric Institute, dinner meeting and lighting demonstration, Nela Park, 6:30 p.m.

Great Progress in Metal-Working Equipment To Draw Huge Crowd to Machine Tool Show

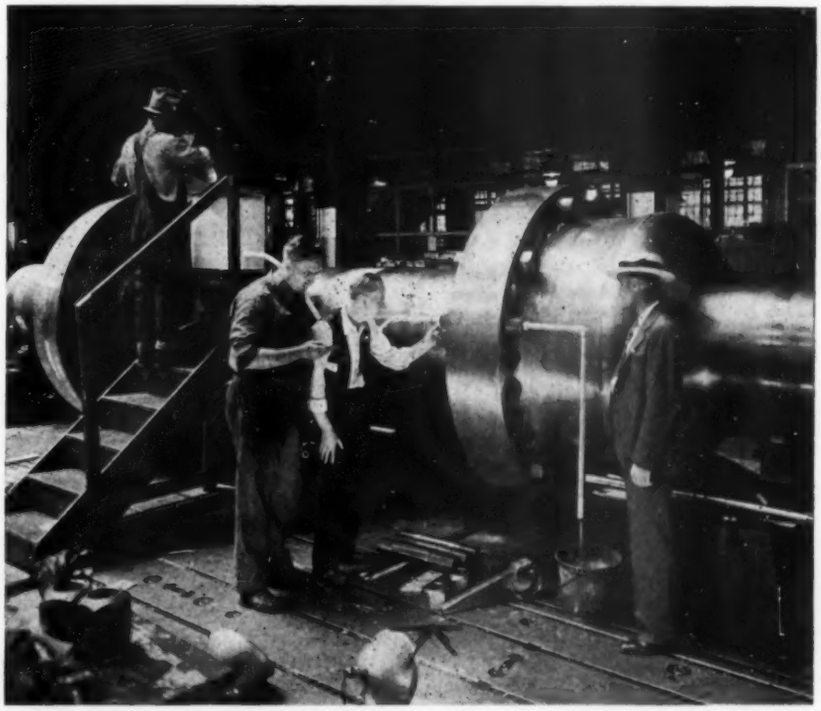
CANCEL BRITISH ENGINEERS' VISIT

NEW YORK—The British-American Engineering Congress, scheduled to be held in New York City Sept. 4-8, has been cancelled because of unsettled European conditions. Some 300 members of the Institution of Mechanical Engineers and the Institution of Civil Engineers, who had planned to meet with the A.S.M.E. and the A.S.C.E. at their combined fall meeting, deemed it inadvisable to make the trip since many are key men in Great Britain's industrial mobilization scheme. Plans for presentation of papers already prepared will be revealed later.

Heavy Registrations Indicate Attendance Will Break All Records

CLEVELAND—No mere collection of metal-working equipment will be the 1939 Machine Tool Show. Rather the show will mark the culmination of a ten-year period of intensive research and engineering study, feature the results of knowledge gained through many actual shop applications, include machines unheard of in 1935.

Knowing this, thousands of metal-working executives from a score of countries have flooded the show committee with advance registrations. Walter W. Tangeman, committee chairman and Cincinnati Milling Machine Co. vice-president, predicts



Swell Fit—*Coupling bolts connecting water wheel and generator shafts of 30,000-kva generator swell up after being put in place by the familiar dry ice process. Only way to get them out again was to make them hollow, pour alcohol chilled to 40 below through them. Assembly is part of a unit being made at Allis-Chalmers' Milwaukee works for the Tennessee Valley Authority*

that attendance during the Oct. 4-13 period will break all previous records.

Every square foot of available floor space has long since been taken, and exhibitors are rushing to completion scores of new machines incorporating latest refinements. Over 400 freight cars and most of Cleveland's trucking facilities have been requisitioned for the vast last-minute moving and installation job.

Actual exhibit space will total 150,000 sq.ft., nearly fifteen per cent more than that of the 1935 show. Power available for machinery to be in operation has been increased to 9,000 hp. Special lighting has been arranged in the exhibit halls. Physical arrangement of exhibits has been planned to promote maximum visibility and minimum crowding.

Wendell E. Whipp, National Machine Tool Builders Association president and Monarch Machine Tool Co. president, asserts that "we expect that visitors at this show will be amazed at the developments which they will find to have been taking place in the machine tool industry in the last few years.

Theories Tested in Practice

"In the depths of the 1929–1933 depression machine tool research departments and engineers took advantage of slack times to search for new methods and new improvements which they knew would be required to meet the increasingly exacting demands of America's manufacturing enterprises when recovery arrived.

"At the 1935 show, some of the fruits of this research had taken form—but a large share of the new concepts and ideas originated during depression days still required further testing and development before they could be placed on the market. During the last four years this testing and development has taken place. The machines which will be shown at this year's show represent in fact the culmination of a ten-year period of intensive research and engineering study, designed to make available to American industries methods of cost reduction and increased productivity which, I am convinced, substantially surpass in performance machine tool equipment which has thus far been available."

Participate in Machine Tool Congress

Prominent attraction at the show will be sessions of the Machine Tool Congress Oct. 4–12. Contributing information to be thus exchanged will be the American Foundrymen's Association, American Society of Mechanical Engineers, American Society of Tool Engineers, Associated Machine Tool Dealers of America, Cleveland Engineering Society, General Electric Institute, National Association of Foremen, National Electric Manufacturers Association, and Society of Automotive Engineers.

PLANS INDIVIDUAL PRESS SHOW

MT. GILEAD, OHIO—Hydraulic Press Mfg. Co., builder of "H-P-M Fastraverse" presses, has completed plans for conducting its own show at its Mount Gilead plant during the time of the Machine Tool Show in Cleveland.

Decision was made because at past exhibits it was feasible to show only one type of press in full operation. With the plant but a short distance from Cleveland, the company management feels it logical to maintain open house during the entire ten days of the Show.

EXPORTS OF MACHINE TOOLS FROM ENGLAND RIVAL IMPORTS

LONDON — England's exports of machine tools, valued at 2,838,109 pounds, in the first half of 1939 were almost as much as her imports, which totaled 3,151,417 pounds. Forty-seven per cent of the exported machine tools went to Soviet Russia. British countries took machine tools valued at 743,801 pounds, France 180,821 pounds and Japan 158,923 pounds. Lathes, including screw machines, valued at 1,045,972 pounds were exported. Fifty-three per cent of the machines imported into England were from the United States. Germany supplied equipment worth 827,645 pounds.

U. S. Government Contracts Awarded to Metal-Working Firms

(Last-minute awards on page 690 b)

Contractor	Government Agency	Commodity	Amount
Kutztown Foundry & Machine Corp., Kutztown, Pa.	Navy, S. & A.	Chairs	$80,853
Florence Pipe Foundry & Machine Co., Florence, N. J.	D. C. Government	Cast iron pipe	79,144
National Twist Drill & Tool Co., Detroit, Mich.	Navy, S. & A.	Drills	29,487
Republic Steel Corp., Cleveland, Ohio	War, Ordnance	Steel	33,509
Peco Mfg. Corp., Philadelphia, Pa.	War, Ordnance	Eyebolt lifting plugs	20,028
Niles-Bement-Pond Co., Pratt & Whitney Div., Hartford, Conn.	War, Ordnance	Machine tools	71,490
Davenport Machine Tool Co., Rochester, N. Y.	War, Ordnance	Screw machines	19,716
Bryant Chucking Grinder Co., Springfield, Vt.	War, Ordnance	Chucking grinders	20,120
Rivett Lathe & Grinder, Inc., Boston, Mass.	War, Ordnance	Grinders	22,421
William Sellers & Co., Philadelphia, Pa.	War, Ordnance	Boring mill	21,853
Worthington Pump & Machinery Corp., Harrison, N. J.	Navy; War	Pumps	680,716
Electric Boat Co., Groton, Conn.	Navy, S. & A.	Mufflers	70,960
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.	War; T.V.A.	Electrical equipment	93,185
The Corbitt Co., Henderson, N. C.	War	Trucks	101,526
Rust Furnace Co., Pittsburgh, Pa.	Navy, S. & A.	Furnace	68,074
Hardie-Tynes Mfg. Co. and Koppers Co., Bartlett-Hayward Div., Birmingham, Ala., and Baltimore, Md.	Interior	Ring-follower gates	548,400
Columbia Steel Co., Worcester, Mass.	Navy	Cable	27,752
A. N. Eaton Metal Products, Omaha, Neb.	Agriculture	Grain bins	80,000
Martin Steel Products Corp., Tiffin, Ohio	Agriculture	Grain bins	626,200
Columbian Steel Tank Co., Kansas City, Mo.	Agriculture	Grain bins	299,625
Butler Mfg. Co., Galesburg, Ill.	Agriculture	Grain bins	2,303,975
Sioux Steel Co., Sioux Falls, S. D.	Agriculture	Grain bins	133,370
Edwards Mfg. Co., Cincinnati, Ohio	Agriculture	Grain bins	168,350
Scovill Mfg. Co., Waterbury, Conn.	Treasury	Nickel blanks	51,500
International Nickel Co., New York, N. Y.	Navy, S. & A.	Alloy forgings	92,208
American-LaFrance-Foamite Corp., Elmira, N. Y.	Navy, S. & A.	Fire extinguishers	29,825
Jones & Lamson Machine Co., Springfield, Vt.	Navy, S. & A.	Turret lathes	20,387
The Carborundum Co., Niagara Falls, N. Y.	Navy, S. & A.	Abrasive wheels	35,000
Brown & Sharpe Mfg. Co., Providence, R. I.	Navy, S. & A.	Machine tools	49,183
Ferracute Machine Co., Bridgeton, N. J.	War, Ordnance	Vertical press	22,215

CANADIAN SHIPBUILDING FIRM BEGINS ARMAMENT PRODUCTION

MONTREAL—With a $6,000,000 educational order from the British War Office for 25-lb. field guns and gun carriages as a start, Marine Industries, Ltd., shipbuilding concern of Sorel, Quebec, has begun development of a large armanent construction industry on the banks of the St. Lawrence River midway between Montreal and Quebec.

Simultaneously with the landing of the British government order, the company completed an arrangement with Schneider-Creusot, large French armament firm, whereby Marine Industries will utilize the French company's licenses and technique in arms manufacture. Schneider-Creusot is sending to Canada technical experts to train Sorel workmen in munitions making.

The Schneider-Creusot arrangement links up with plans of the French government for large-scale expenditures in Canada, in conjunction with those of Britain, for developing armament production facilities relatively safe from air attack and capable of tremendous expansion in event of war.

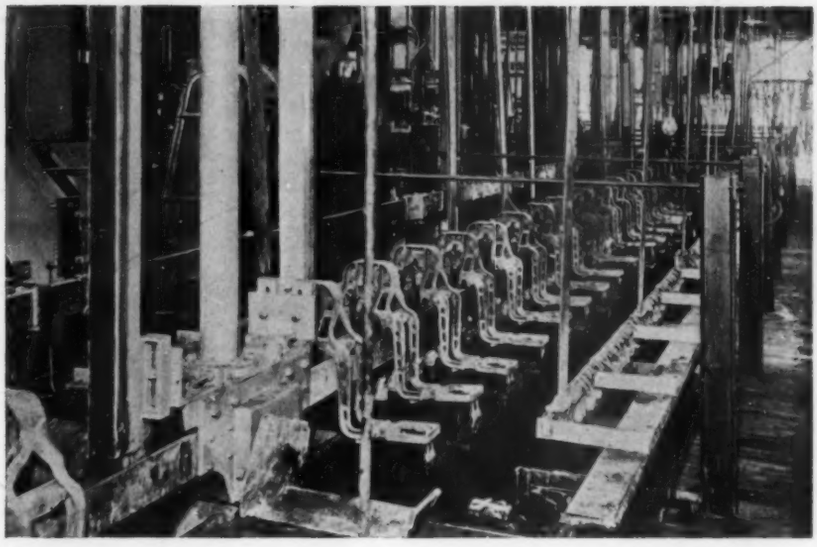
Marine Industries plans to place subcontracts with other Canadian companies that have been equipping themselves for armament manufacture. Much of the precision machinery to be used at Sorel will be imported, and some of the work may be done outside the Dominion, at least to start.

Other important British orders likely to be placed shortly include contracts for Bren carriers—truck-like vehicles armed with several Bren machine guns—small armored cars with caterpillar treads, and 2-lb. anti-tank guns.

SAFETY COUNCIL TO MEET

CHICAGO—Over 500 speakers and discussion leaders will guide the hunt for hazards at the 28th National Safety Congress to be held in Atlantic City, N. J., for five days beginning Oct. 16.

Special sessions will be given over to such industrial problems as welding and cutting, off-the-job accidents, fire control, occupational diseases, handling of fumes, gases and vapors. Delegates will study new types of guards and protective equipment, learn new psychological devices to keep men interested in safety, analyze new ways to handle old hazards. "The Human Side of Safety" will receive particular attention in four special sessions conducted by a physician, a psychiatrist, two personnel experts. Also featured will be an exposition of safety devices to illustrate recent developments in fool-proofing machinery.



Plating by the Ton—*Claimed to be the world's largest, this nickel plating tank is used to plate automobile bumpers by the Standard Steel Spring Co., Coraopolis, Pa. Made of $\frac{3}{8}$-in. steel plate lined with $\frac{1}{4}$ in. of rubber, it is over 67 ft. long, 6 ft. wide and 8 ft. deep. Operating volume is 27,500 gal., anode weight is 33,000 lb., current available is 25,000 amp. at 6 volts.*

BETTER INDUSTRIAL RELATIONS DISCUSSED AT SILVER BAY

LAKE GEORGE, N. Y.—Industry sets the tempo of modern life. That this is daily being recognized more clearly by industrial executives everywhere was forcefully brought out in the 22nd annual industrial relations conference held Aug. 30-Sept. 2 at Silver Bay, Lake George, N. Y.

Stressing the theme "Better Industrial Relations Through Better Understanding," executives, personnel men, editors, foremen, workers discussed progress, exchanged ideas, deliberated future developments.

Discussed were many problems affecting human relations in complex industrial life. Sick benefits, medical care insurance, hospital plans were analyzed Wednesday, Aug. 30, by L. O. Pethick, Metropolitan Life policyholders' service bureau industrial service director. Same day problems of handling grievances and providing information for employees came in for their share of attention. Socony-Vacuum industrial relations manager C. R. Dooley opened the session.

Following day included morning and evening sessions. During the morning Dennison Mfg. Co. president Henry S. Dennison analyzed factors upon which employment and income may be stabilized. Sectional conferences followed, provided discussions of trends in old age pensions, seniority, group health, medical care. Evening session comprised a symposium on what management can do to help the foreman, was headed by C. S. Coler of Westinghouse.

What the National Labor Relations Act means in the light of court actions provided the subject of Friday morning's address by Henry Clifton, Jr., New York attorney. Following came sectional conferences treating problems encountered in employee attitude determination, job evaluation, salary administration. Evening's addresses discussed constructive collective bargaining techniques, aptitude studies as an aid to supervision.

Morning of Saturday, Sept. 2, was reserved for the closing address of the conference, "What's Ahead for Management?"

TOOL ENGINEERS TO MEET

CLEVELAND—With more than 500 members expected to attend, the American Society of Tool Engineers will hold its semi-annual meeting at the Hotel Statler, Oct. 5 and 6, coincident with the National Machine Tool Show and Congress.

"Plain vs. Anti-Friction Bearings, Their Application and Use Particularly as Applied to Machine Tools," will be the subject of the technical session opening the meeting. There will be three papers on this subject, one from the plain bearing group, one from the anti-friction bearing group, and one from the bearing field in general.

The following day's session will be devoted to the second report by the Fact Finding Committee under the chairmanship of John Younger, Ohio State University, on "The Effect of the Development of the Machine on Employment and Our Standard of Living."

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

Automobile manufacturers make plans for a 20 per cent increase in production. Importance of AFL continues to drop. CIO strikes at various parts plants.

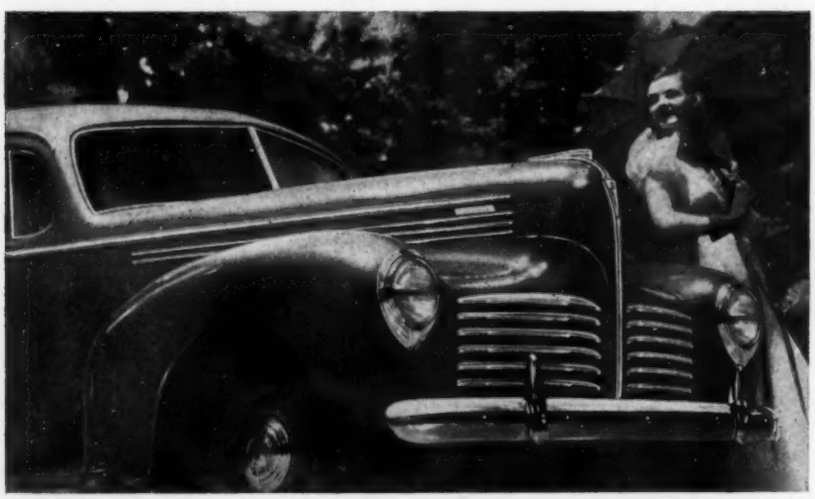
DETROIT—Ford surprised the industry by resuming assemblies on Sept. 5 after only a three-weeks shutdown for model changeover. Observers are inclined to believe that changes in front-end and body will not be extensive. That is, these modifications will probably not approach the thoroughness with which Plymouth has revised its body styling (and increased the wheelbase too) or the efforts of Chevrolet to bring out an entirely fresh design.

There is talk that Ford intends to drop each of the lines a notch, which is in effect a price cut. Last year, it will be remembered, the previous deluxe job was carried over as the standard model and a new deluxe series was started. Whatever is done, it would be strange indeed to see Ford sacrifice competitive position by a minor refurbishing.

Chevrolet outsold Ford this year in all states except Michigan, and the margin is expected to reach approximately 75,000 cars. Plymouth also had an exceptionally good year and will come out soon with a new model as big as last year's Dodge. There has been considerable activity in the Ford and Lincoln tool engineering departments. In addition, the new tool and die shop at Rouge has ample facilities to get out a huge volume of work, and at a 25 per cent saving in time over earlier seasons. With ample resources available and with an organization believed geared to faster changes, Ford is expected to announce models to match competitors in styling, possibly wheelbase and price.

Chevrolet to Boost Production

M. E. Coyle, Chevrolet president, said recently at a car-less preview (assembly operations do not commence until Oct. 2 because of the tool and die strike) that 200,000 passenger cars and 60,000 trucks are projected for the last quarter. He refused to make any predictions concerning how much better the entire 1940 selling season will be as compared to the one just closed, saying that too many influences such as war and business cycles prevent intelligent prognostications. The monthly totals are expected to be 65,000 cars and trucks in October and 100,000 in both November and December. Truck production starts a bit earlier this year. Despite the late start Chevrolet will build more vehicles this fall than last, when 190,000 new-model cars and 40,000 trucks were manufactured before the year end.



Early Bird—*First to get into 1940 production was Hudson, with cars coming off its line around Aug. 1. All models will sport front-end design shown. Gadgets include combination hood-mounted parking lights and direction signals*

It is probable that Ford will outstrip Chevrolet in assemblies by Jan. 1, because his plants will be in production four months as compared with three for his competitor.

Buick Output Also Up

Buick has "set its sights" upon a domestic output of 240,000 units in the words of Harlow H. Curtice, president and general manager. This is a 20 per cent increase over the 208,000 cars sold in the 1939 model. The GM division has already launched itself on the manufacturing program of 100,000 cars by the first of the year. Commitments representing $40,000,000 for materials, supplies and wages in the next 60 days have already been made. Plant changes, retooling and similar expenditures amount to $8,000,000. There will be four lines, including a new Super 50 and a Roadmaster 70, featuring the "Torpedo" body, an entirely new design pioneered by Buick and as wide as the front fenders. Even a venetian blind is featured in the sedan model. Incidentally, Buick will not use the name Torpedo, but Pontiac will do so on its special eight. In fact, this body in sedan and coupe types is to be offered on the Buick, the Pontiac and the Olds.

Pontiac will have four lines—a new low-priced six, a deluxe six, an eight comparable to last year, and the Torpedo eight. H. J. Klingler, general manager, expects that 175,000 Pontiacs will be made, an increase of 20 per cent over 1939 and 75 per cent over 1938. Oldsmobile, which made almost as many cars as Pontiac, can be expected to have a similar increase. During September, Pontiac should build 15,500 cars and reach about a 20,000 top in November and December. It assembled about 3,000 cars in August and should have its dealers well stocked by show time.

Chrysler Expenditures Heavy

Chrysler Corp. spent $12,000,000 for new tools, dies and fixtures in its various plants, and this amount does not include new manufacturing equipment or plant re-arrangement. K. T. Keller, Chrysler president, said at a private press preview that his corporation has departed from the usual practice of continuing body dies for two years, and that all the tools made for 1939 production had been scrapped. He pointed to the $25,000,000 profit during the first six months and to consumer acceptance as being proof that the policy of offering a really new car each year is well worth while in the case of those who can afford to do so. Details of the new cars can not be revealed, but it can be said that all Chrysler cars make use of the Air-

flow principles to attain more body width and a better ride. They are longer in wheelbase, feature luxurious upholstery and trim and give even more trunk capacity through a distinctly different rear end.

Thumbs Down on AFL

Recent plant elections demonstrate the strength of the CIO in Detroit. At Packard the vote was 4 to 1 in favor of the CIO, at Motor Products it was 10 to 1, and at Bundy Tubing (thought to be an AFL stronghold) it was 6 to 5. Only 7 per cent of the men in these three plants voted for "neither" on the ballot, which is viewed by the CIO group as being a good augury for thumping victories in the Briggs vote on Sept. 14, the Chrysler vote to be held later, and finally the elections in General Motors plants about the middle of October.

The "neither" vote was the unknown quantity, and CIO spokesmen were frankly disturbed about its possible strength a month ago. Now with the Martin influence waning still more in outlying districts, the CIO frankly expects to win all Chrysler plants except possibly Kokomo. In General Motors, it is a bit worried about the Janesville plant. Ford organizing work is still going on, but an attack there is not in the cards until overwhelming strength can be demonstrated in Chrysler and General Motors.

Packard's election was not detrimental to production that day, say union sources, because the management made it easy for the men to reach voting booths.

Homer Martin has been "banished" to Flint by the AFL, and Jack Little, his strongest lieutenant there, has resigned and is said to be seeking to enter the CIO camp. But the olive branch has not yet been extended for reasons of policy. Lester Washburn, the Lansing auto labor leader, has been withholding dues' payment to the AFL, it is said, and may follow Little's example.

Core—*Pattern maker in Buick foundry rushes work on a Dowmetal core box, using milling machine with high-speed head attachment. Though late in getting going, Buick expects to assemble 100,000 cars by year's end*

No. 1 Buick—*First 1940 Buick to roll off assembly line meets rigid inspection by company officials. Examining new car are, from left, W. F. Hufstader, general sales manager; O. W. Young, general manufacturing manager; stylist Russell Patterson; and Harlow H. Curtice, president and general manager*

Parts Plants Strikes

Studebaker is reported to have interrupted production temporarily because of a shortage of transmissions coming from the Warner gear plant in Muncie. The strike was settled last week with the company agreeing to give plant-wide seniority, an average raise of 6 cents per hour to production workers, and an "understanding" that Warner is now to be a closed shop, although that stipulation was not made in writing.

An assault is being made upon the Detroit bearing industry. Federal Mogul, Bohn Aluminum & Brass plant No. 1, and Detroit Aluminum & Brass are to be struck by CIO forces if the demands of that union's Bearing Council are not met. An offer is reported to have been made to these three concerns some time ago toward development of a uniform contract that would become the basis for stabilizing hours of employment and wage rates (with some differentials) for the entire bearing industry. The concerns refused to treat, and Federal-Mogul was the first struck. The CIO demands a preferential (union) shop, abolition of piece rates and standardized wages. If these shops capitulate the Bearing Council intends to enforce the same conditions upon eastern bearing manufacturers.

HIGH STRENGTH SAFETY GLASS FEATURED IN MOST 1940 CARS

DETROIT—Practically all automobile manufacturers will equip their 1940 models with a new high test safety glass under development for the past six years. Glass sheets are now being laminated with "polyvinal acetal resin" instead of cellulose acetate. Resulting glass is six times as strong at zero, twice as strong at 70, and of about the same strength at 100 deg. F.

Two varieties of high test safety glass will be used: *plate* glass in which both sides of the two sheets are ground and polished, and *sheet* glass which consists of two sheets of window glass not ground and polished. Automobile manufacturers are not unanimous in agreeing that the plate glass variety is the best material to use for all windows. They do specify it for the windshield because plate glass is superior for visual efficiency. But some makers, including Ford, contend that the difference is not enough to warrant use of the more expensive safety plate glass in side windows. All General Motors cars will use the new safety plate glass throughout because a series of tests conducted by Libby-Owens-Ford shows that eye fatigue is 62 per cent greater with sheet glass. Chrysler will use heat-treated glass bent to the curve of the rear deck for the rear window.

Cost of high test safety glass is about the same as previous type. Thickness of plastic now used is 0.015 in. instead of 0.025 in., but strength is markedly increased. When the cost of polyvinal resin is reduced, a thicker sheet may be used, giving an even greater margin of safety.

WATCHING WASHINGTON

McGraw-Hill Washington Bureau

PAUL WOOTON, CHIEF

New War Resources Board strives for preparedness rather than neutrality, works in close cooperation with trade associations, would be pivotal point of industrial mobilization scheme.

WASHINGTON — Scenes are being enacted in Washington reminiscent of the Council of National Defense in 1916. Appointment and assembly of the new War Resources Board transformed the "office" of the Assistant Secretary of War from a quiet, routine sector of the Munitions Building into a crowded beehive buzzing with activity. Extra clerical help overpopulate existing quarters. Reception rooms brim with waiting callers.

The "office" of the Assistant Secretary of War even in normal times is in reality a large bureau occupying a whole tier of offices. As no extensive rearrangement of office space is being made pending developments in Europe, the resulting crowding and clatter present the same picture as did the Munsey building in 1917, when Walter S. Gifford, also a member of the present board, was director.

The Council of National Defense had a much more difficult task. Thanks to the Army and Navy Munitions Board and the industrial planning that has been done by the government through the years, together with the great improvement in basic statistics, the task is now much simpler. When Director Gifford started to work in 1916 much less was known about all raw materials. There were no figures to show where raw materials went and just the use that was made of them.

Trade Group Advantages Realized

The War Resources Board is in a position to call on various government agencies that can supply nearly all needed figures. In addition there is now a vigorous trade association in practically every industry. It took the World War to bring about the organization of trade associations in many important industries. In the twenty-two years that have passed these associations have become highly organized and are in possession of practically any information that the Board may want. Even if the Board should call for information that is not on hand a representative of the particular industry can be called in quickly and acquainted with the problem. Through the trade association he is in a position to get the answer from an entire industry in a very short time. This leads to the conclusion that there will be fewer headaches for this board than had the Council of National Defense.

Just as the Council of National Defense was turned into the War Industries Board as the emergency increased in gravity, the War Resources Board, now an advisory arm of the Army and Navy Munitions Board, would become the War Resources Administration, reporting directly to the President. By setting up a skeleton organization it will be possible to handle quickly and effectively the transition from a peace to a war economy. It would attempt to coordinate the economy of the country with particular attention to the munitions requirements of the Army services but with due regard for the needs of the civilian population. If the country is drawn into the war it then would be necessary to distribute the war load as equitably as possible, both socially and geographically. It would mean a reduction of the activities of the less essential industries or their conversion to more useful purposes. It probably would be found necessary for the civilian population to reduce its requirements for items absolutely needed.

SIDESTEP EMBARGO

WASHINGTON—The embargo on "arms, ammunition and implements of war," which must, under the neutrality law, be clamped down on all belligerents the moment war is declared in Europe, will be a lawyers' headache—not a completely crippling regulation to airplane and other "implement of war" manufacturers, in the opinion of Administration insiders.

Utterly out of sympathy with an embargo, the Administration will be anxious to find loopholes. Administration lawyers are worrying almost as much about just how to keep the U. S. supply of airplanes and munitions pouring into Britain and France as are other officials about how to cushion the blow to American finance. But so strong is the determination that there is not as much for manufacturers to worry about as they now think.

Would Govern Industrial Mobilization

It is pointed out at the office of the War Resources Board that the War Resources Administration would be the pivot around which war-time industrial mobilization would turn. While it would make and enforce decisions the actual administration of the various activities would be in the hands of the regular agencies handling them or in the hands of new agencies which would be created for the purpose.

At the beginning, at least, the principal activity would be the establishment of basic priorities and classification ratings so that essential needs could be met first. Other subdivisions would be War Finance, War Trade, and War Labor. There would also be staff divisions dealing with administration, legal matters and statistics. Then there would be the coordinating divisions dealing with transportation, power and fuels, commodities and facilities. There would be separate sections for the important commodities.

The different divisions of the War Resources Administration would be overhead clearing houses in the event emergency became such that it would be necessary to set up emergency administrations as was done in the last war.

Board Selections Approved

President Roosevelt on Aug. 9 approved selections for the War Resources Board as follows: Edward R. Stettinius, Jr., chairman of the board U. S. Steel Corp.; Karl T. Compton, president Massachusetts Institute of Technology; Walter S. Gifford, president American Telegraph & Telephone Co.; Harold G. Moulton, president The Brookings Institution; John Lee Pratt, director General Motors Corp.; Gen. Robert E. Wood, chairman Sears Roebuck & Co.

The first meeting of the Board was held Aug. 17. Since that time the Board has been practically in continuous session. Much midnight oil has been burned.

Works for Preparedness

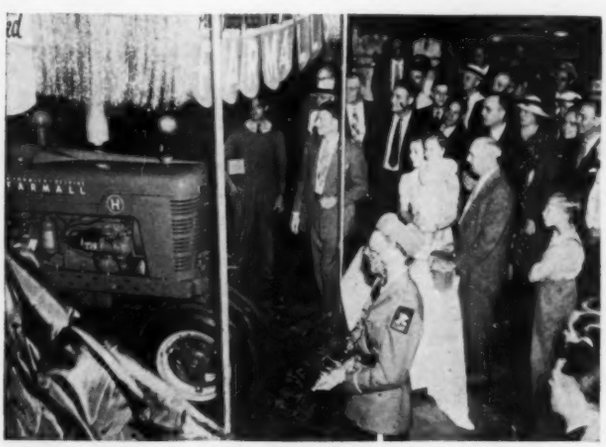
The feeling in Washington is that the appointment of the Board was none too soon. It does not deal with the problems of neutrality. Its work is that of preparedness. Mr. Gifford forms a link of continuity between the old Council of National Defense and War Resources Board and the new War Resources Board. In this way it is believed that many of the mistakes of 1916 and 1917 may be avoided.

FARMALL TRACTOR DEMONSTRATIONS DRAW RECORD TURNOUT

ROCK ISLAND—Month ago Rock Island's 15,000-person stadium for the first time was packed to capacity. Occasion was not a big league ball game but night demonstrations of International Harvester's Models H and M Farmall tractors.

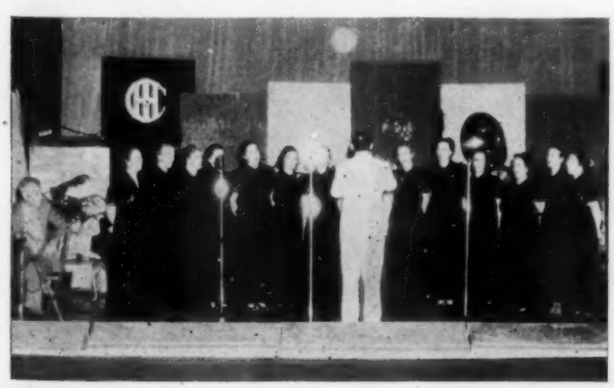
Performance was a fitting climax to the day's celebrations. At a chamber of commerce meeting that noon president Sydney G. McAllister had told some 400 business men that "today your Farmall works is the largest agricultural tractor plant in the world." That he meant to keep it that way was indicated when the new models were unveiled later. Afternoon's doings included a trip along the plant's assembly line, an impressive show of tractors being put through their paces. Townspeople, knowing full well how firmly their welfare is hitched to farm implements, that night jammed the stadium to glimpse the company's progress, guess as to its future.

Sydney G. McAllister, *International Harvester president, praised Rock Island as tractor industry center in an address at its chamber of commerce luncheon Aug. 9. Occasion was the introduction of Models H and M, which, along with the previously announced Model A, give promise of continued expansion for the company. Over 400 business men attended the celebration, watched movies relating the company's growth, received souvenir toy tractors. A whopping success, affair was first of its kind for International Harvester*



Revealed *in all its crimson beauty is the Model H as plant superintendent E. H. Sohner's two-year-old granddaughter pulls the rip cord. Unveiling took place in Fort Armstrong Hotel lobby following luncheon ceremonies*

Performance *of new models impressed business men as machines were put through their paces. Spectators also saw tractor raised by its own power with the hydraulic "Lift All," had previously toured plant assembly line*



High spots *of the evening's ceremonies for the public included parties for employees, concerts by local bands and entertainment by the Ladies' Auxiliary, above. Some two hours of the program was broadcast over station WHBF*

"Parade of Power" *climaxed night's public demonstration of the new tractors. Enthusiasm of townspeople resulted in Rock Island's 15,000-person stadium's being jammed to capacity for first time since its opening in 1929*

Like Father, Like Son—*Allis-Chalmers special steam turbine inspector Putnam L. Pitcher, right, retiring after 51 years' service, hands over his instruments to his son Harry as president Max W. Babb looks on. Harry trained for the job by working beside his father for the past 25 years*

BUSINESS ITEMS

Ajax Flexible Coupling Co., Westfield, N. Y., has appointed the Urquhart Service Co., Denver, Colo., and Salt Lake City, Utah, as its sales representative.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has opened a branch office in Louisville, Ky., under the supervision of W. E. KERCHEVAL. The company has also opened a branch at La Porte, Ind., under the direction of B. L. MARGESON, formerly in charge of the Rockford, Ill., office. J. J. BREUTZMAN, formerly of the Chicago office, will succeed Mr. Margeson at Rockford.

Chiksan Tool Co., Fullerton, Calif., has appointed the Crane Co., Chicago, Ill., as distributor for its swing joints.

The Florida East Coast Railway and the Atlantic Coast Line Railroad have each purchased two 7-car stainless-steel light-weight trains from the Edward G. Budd Mfg. Co., Philadelphia, Pa. Equipped with 2,000-hp. diesel electric power plants, each train includes a dining car, baggage coach, four all-chair cars and a newly designed combination observation and tavern car.

Diehl Mfg. Co., Elizabethport, N. J., manufacturer of electric motors, generators and ventilating equipment, has opened an office in Charlotte, N. C., under the supervision of JAMES H. LEWIS.

Electric Auto-Lite, Ltd., of Canada, is making preparations for the Canadian production of Auto-Lite spark plugs, according to A. F. OLIVER, recently named division manager. Facilities of the company's plant at Sarnia, Ont., are being expanded by building additions totaling 8,000 sq.ft. and by an investment of some $70,000 in new equipment.

Fleet Aircraft, Ltd., has completed a new addition to its factory in Fort Erie, Ont.

Grob Bros., Grafton, Wis., are erecting a $15,000 plant to manufacture stainless steel stampings.

Hegewisch Car Corp. has been formed to acquire the property of the Ryan Car Co. of Hegewisch, Ill. This move has been made as part of the company's plan of reorganization under voluntary 77B proceedings approved by the court. The plant covers 80 acres and has a capacity for repairing and building about 8,000 railroad cars annually.

R. Hoe & Co., New York, N. Y., printing press and saw manufacturer, has formed an industrial division to facilitate its program for diversifying the company products.

Jones, McDuffee & Stratton Corp., Boston, Mass., has been given the second major distributorship for the General Electric Company's commercial refrigeration products.

Metallizing Co. of America, Inc., has opened a sales and service office in Newark, N. J., under the supervision of WILLIAM MCMAKIN.

Moosup Products Corp., with capital stock amounting to $75,000, has started operations in the plant formerly occupied by Aldrich Bros. at Plainfield, Conn., manufacturing metal articles and alloys.

Oakite Products, Inc., New York, N. Y., producer of industrial cleaning materials, has added the following men to its sales and service organization: H. LOVE, Pittsburgh; CHARLES E. HUGHES, Vermont and New Hampshire; B. O. KENDALL, Los Angeles; R. L. FAIRCHILD, Cleveland; W. C. THIESS, Detroit; JOHN MACKESY, San Jose, Calif.; and E. M. JAHRAUS, Portland, Ore.

Phoenix Machine Co., Cleveland, Ohio, manufacturer of die casting and plastic equipment, has appointed Dowding & Doll, Ltd., Westminster, London, England, as its European distributor.

H. K. Porter Co., Pittsburgh, Pa., manufacturer of industrial and switching locomotives, has established a separate division for the design and manufacture of many types of processing equipment, including ball and pebble mills, tube mills, agitators, mixers, blenders, autoclaves, kettles, tanks, and similar articles.

Parkersburg Rig & Reel Co., Parkersburg, W. Va., manufacturer of steel derricks, tanks, brakes and pumping units, is planning to acquire the Oil Country Specialties Mfg. Co., which operate plants in Kansas, Texas and California making special machinery for the oil industry. The transaction, by which both companies would continue to operate independently, would involve approximately $1,500,000, according to C. A. RUFF, vice-president and general manager of the Parkersburg concern.

Progressive Welder Co., Detroit, Mich., has appointed the R. C. Neal Co., Buffalo, N. Y., as distributor.

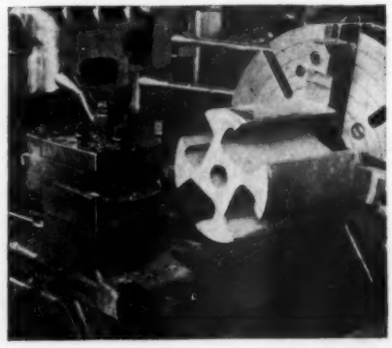
Ransome Concrete Machinery Co., Dunellen, N. J., has appointed W. S. Hiler & Co., El Paso, Tex., as Western Texas, New Mexico, Mexico and Arizona representative for its line of welding tables and positioners.

Safety Grinding Wheel & Machine Co., Springfield, Ohio, has appointed LOUIS M. SLACK as its representative in the Northern Ohio district, with headquarters in Cleveland.

Swanson Machine Co., Jamestown, N. Y., is planning a one-story plant addition to cost $50,000.

Universal Gear Corp., Indianapolis, Ind., has opened a direct factory sales office in New York, N. Y. M. E. ROBBINS, assistant director of sales, has been placed in charge of the Eastern district.

Harry C. Weiskittel Co. Baltimore, Md., manufacturer of stoves and oil burners, will build a 100x180-ft. foundry addition estimated to cost around $10,000.



Tough—*Haynes Stellite "2400" bit makes easy work of this $\frac{3}{16}$-in. interrupted cut in a tough cast semi-steel pump rotor. Surface speeds of 124–165 ft. per min. and feeds of 0.036–0.042 in. per rev. were used*

PERSONALS

G. P. AIRHART, since 1924 associated with the General Electric Co. and lately connected with the engineering department of the Pittsburgh office, has been appointed engineer at the Baltimore office.

H. E. BILLINGTON has been made executive vice-president of Kellogg Switchboard Supply Co., Chicago, Ill. Mr. Billington joined the company as manager of telephone sales in 1927, became general sales manager in 1931 and vice-president in charge of sales in 1937.

WALTER P. CAHILL, for the past twenty-odd years associated with Graton & Knight Co., Worcester, Mass., has resigned as general superintendent and member of the board.

FRED W. CEDERLEAF has been named works manager of the Dodge Mfg. Corp., Chicago, Ill. Mr. Cederleaf was formerly general manager of the Diesel Equipment Corp., Chicago.

GEORGE B. COMFORT, former factory manager and more recently manager of engineering sales for Schramm, Inc., West Chester, Pa., air compressor manufacturer, has been appointed manager of sales promotion.

EARL D. CONANT, former vice president of the Buda Co., Harvey Ill., has opened offices at 346 W. 107th Place, Chicago, and will act as manufacturers' agent for several lines of small tools and machine shop equipment in the Chicago area.

CHARLES R. D'OLIVE has been appointed manager of the household appliance division of Stewart-Warner Corp., Chicago, Ill., supervising all household appliance activities, including sales, merchandising and engineering. Connected with Stewart-Warner from 1933 to 1937 as manager of the refrigerator division, he returns from the Crosley Corp., where he has been vice-president in charge of the refrigerator division.

A. B. FROST has been appointed branch manager of the New Haven, Conn., office of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. He succeeds E. D. HILL, who has resigned due to illness.

FRED G. GRONEMEYER, resident engineer of the Springfield, Mass., plant of the Plastics Div., Monsanto Chemical Co., has been appointed plant manager. Mr. Gronemeyer joined Monsanto in 1929 as a plant maintenance and construction engineer. In 1935 he was transferred to the research department as a development engineer.

LAWRENCE E. JOSEPH

J. DOUGLAS DARBY

LAWRENCE E. JOSEPH has been appointed executive officer in charge of Blaw-Knox Div., The Blaw-Knox Co., Pittsburgh, Pa. Mr. Joseph succeeds R. F. MCCLOSKEY, SR., a company vice-president, who has been placed in charge of the development of new products for the entire corporation.

Mr. Joseph, until the first of August, was manager of the National Automatic Tool Co., Richmond, Ind. Prior to that connection he was a vice-president of Liggett Spring & Axle Co., and previously was engaged as a consulting engineer.

EARL B. CUTTER, for 34 years a salesman in the Middle West for the Norton Co., Worcester, Mass., retired Aug. 1. EARL C. WILLEY, of the company's Chicago office, has been transferred to Davenport, Iowa, to succeed Mr. Cutter.

ROBERT E. HUNT, formerly in charge of engine development with the Reo Motor Car Co., has been appointed engineer in charge of research and product development, Wilkening Mfg. Co., Philadelphia, Pa., piston ring manufacturer.

M. J. KEARINS, former executive vice-president United Drill & Tool Corp., Chicago, Ill., has been elected president. He succeeds CLARENCE AVILDSEN, retired, who will continue as chairman of the board.

JOHN S. MALONEY, consulting engineer and designer associated with the Gilbert & Barker Mfg. Co., Springfield, Mass., has resigned to become research and project engineer for the Chandler-Evans Corp. at its Meriden, Conn., factory.

JOSEPH E. MCGROGAN has been named manager of the Schramm Dept. of Equipment Rental Co., Philadelphia, Pa. Mr. McGrogan has been associated with Schramm since 1918, most of the time as office manager of the Philadelphia branch.

J. DOUGLAS DARBY has been appointed Philadelphia district sales manager, Carnegie-Illinois Steel Corp., with headquarters in that city.

Mr. Darby has been associated with the steel industry in operating and sales capacities for the past nineteen years. Following graduation from Yale in 1919 he was employed in the open hearth department of the Alan Wood Steel Co. He subsequently became general superintendent, steel division, and later assistant to the vice-president in charge of sales.

JOHN G. MUNSON, since 1928 president Michigan Limestone & Chemical Co., has been elected vice-president, raw materials, United States Steel Corp. of Delaware. He succeeds THOMAS MOSES, who retired Aug. 18 upon reaching the corporation's retirement age of 70, and who will continue in a consulting capacity.

G. R. PROUT has been appointed manager of industrial control sales and W. T. DARCY manager of renewal parts sales, General Electric Co., Schenectady, N. Y., effective Sept. 1. Mr. Prout was formerly acting manager for the Southwestern district of the company's industrial department. Mr. Darcy was formerly assistant to W. C. YATES, in charge of renewal parts sales.

CAPT. H. A. THORNDIKE, formerly export manager for the H. D. Hudson Mfg. Co., Oshkosh, Wis., farm equipment manufacturer, has been named general manager of the firm's recently modernized plant, succeeding K. A. HUDSON.

WALTER C. WALKER, since 1907 associated with the Union Twist Drill Co., Athol, Mass., and head of its form tool department, has retired.

ROBERT N. YATES has been made assistant sales manager of the Erie Foundry Co., Erie, Pa.

OBITUARIES

WILLIAM H. CAIRNEY, 56, president Cairney Engine & Boiler Works, Inc., Stapleton, S. I., N. Y., died Aug. 17 in New York City.

JOHN CARLSON, 79, for 25 years an engineer with the E. W. Bliss Co., Brooklyn, N. Y., died recently at his home in that city.

EDWARD J. CONNOLLY, president Hayes Body Corp., Grand Rapids, Mich., died Aug. 20.

GEORGE HERBERT EISWALD, 66, for many years treasurer of the Phoenix Iron Foundry, Providence, R. I., died Aug. 10 at a hospital in that city.

CHARLES R. ELLICOTT, 54, since 1936 general manager of the Cambria plant of the Bethlehem Steel Corp., died Aug. 22 in a Baltimore, Md., hospital.

MITCHELL FYKSE, 54, chief engineer of the quarry and mining shovel division, Bucyrus-Erie Co., South Milwaukee, Wis., and an employee of the firm for more than 30 years, died Aug. 15 at his home in that city.

WILLIAM M. GRAHAM, 83, until his retirement twenty years ago secretary-treasurer Newton Machine & Tool Works, Atlantic City, N. J., and for some 40 years connected with the company, died April 30.

CARL LAGER, 69, president Morris Machine Works, Baldwinsville, N. Y., died July 17 at his summer home near Old Forge, N. Y.

JOHN MILLER, JR., 67, general superintendent Charles H. Besly & Co., Beloit, Wis., and an employee of the firm for 50 years, died Aug. 21 in a Chicago hospital.

WILLIAM H. MUSSEY, 65, research engineer with the Pullman-Standard Car Mfg. Co., Chicago, Ill., died Aug. 22 at a hospital in that city.

FRED W. SODERBERG, 59, vice-president and a director International Harvester Export Co., Chicago, Ill., and for 42 years associated with the company, died Aug. 18.

COL. GEORGE M. STUDEBAKER, until 1921 vice-president of the Studebaker Automobile Corp., South Bend, Ind., died Aug. 27 in that city following an extended illness. He was 74 years of age.

BENJAMIN WILSON, 58, since 1918 assistant to the vice-president in charge of operations American Car & Foundry Co., New York, N. Y., died recently.

CHARLES C. WOLFORD, 57, superintendent Felins Tying Machine Co., Milwaukee, Wis., for the last eighteen years died Aug. 12.

ABE S. WELLER, 53, president National Foundry Products Co., Milwaukee, Wis., died Aug. 20 at Burlington, Wis.

MEETINGS

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Twenty-second semi-annual meeting, Whitcomb Sulphur Springs, St. Joseph, Mich., Oct. 16-18.

AMERICAN SOCIETY FOR METALS. Twenty-first annual meeting, Stevens Hotel, Chicago, Ill., Oct. 23-28.

AMERICAN SOCIETY OF TOOL ENGINEERS. Semi-annual meeting, Hotel Statler, Cleveland, Ohio, Oct. 5-6.

AMERICAN WELDING SOCIETY. Twentieth annual meeting, Stevens Hotel, Chicago, Ill., Oct. 23-28.

ASSOCIATION OF IRON AND STEEL ENGINEERS. Thirty-fifth annual convention and iron and steel exposition, Wm. Penn Hotel, Pittsburgh, Pa., Sept. 26-29.

INDUSTRIAL MANAGEMENT SOCIETY. National time and motion study clinic, Medinah Club, Chicago, Ill., Nov. 3-4.

MACHINE TOOL SHOW AND CONGRESS, sponsored by the National Machine Tool Builders Association, Public Auditorium, Cleveland, Ohio, Oct. 4-13.

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION. 1939 conference, Hotel New Yorker, New York, N. Y. Sept. 20-22.

NATIONAL SAFETY COUNCIL. Twenty-eighth national safety congress, Atlantic City, N. J., Oct. 16-20.

PACKAGING INSTITUTE. First annual meeting, Edgewater Beach Hotel, Chicago, Ill., Oct 12-13.

PORCELAIN ENAMEL INSTITUTE. Fourth annual forum, Ohio State University, Columbus, Ohio, Oct. 18-20.

SOCIETY OF AUTOMOTIVE ENGINEERS. National aircraft production meeting, Hotel Biltmore, Los Angeles, Calif., Oct. 5-7. Annual dinner, Hotel Pennsylvania, New York, N. Y., Oct. 16.

Exports of Machinery During July, 1939

	July 1939	June 1939	July 1938
Electrical machinery	$8,988,257	$8,717,087	$8,006,504
Power generating machinery except automotive and electric	1,154,835	1,101,760	1,039,002
Construction and conveying machinery	2,912,134	2,558,330	1,745,007
Mining, well and pumping machinery	4,940,898	5,894,925	6,177,260
Power driven, metal-working machinery	9,358,876	6,660,447	6,488,415
Other metal-working machinery	340,843	403,905	338,223
Textile machinery	620,100	798,865	624,594

Exports of Metal-Working Machinery During July, 1939

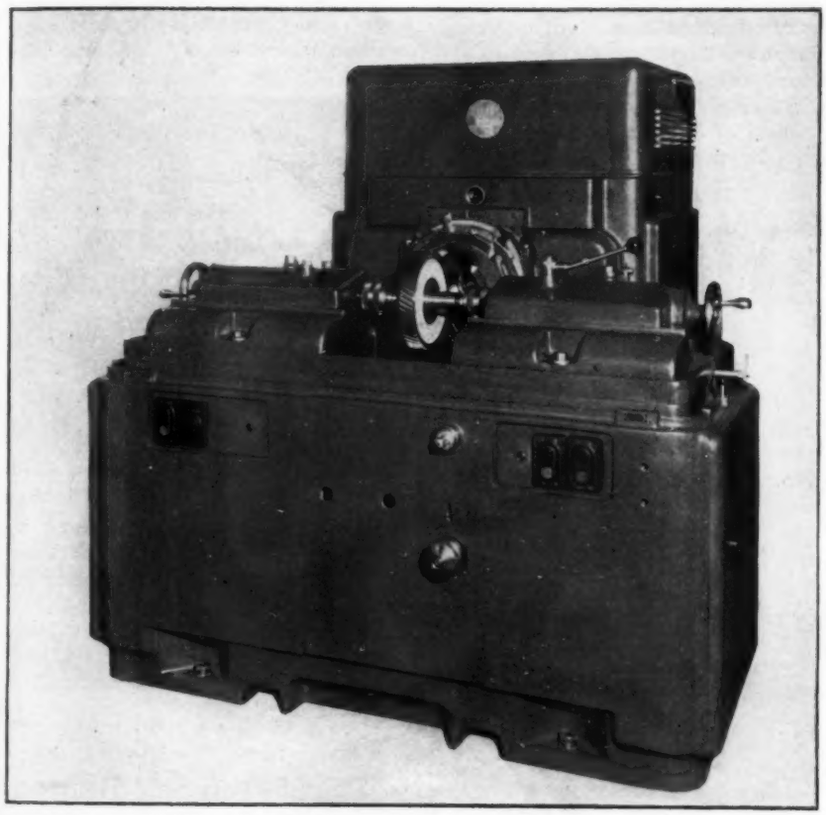
Engine lathes	$554,419	$379,883	$555,536
Turret lathes	698,572	432,869	273,530
Other lathes	317,785	336,465	252,486
Vertical boring mills and chucking machines	638,737	177,625	251,506
Thread cutting and automatic screw machines	528,345	474,003	327,499
Knee and column type milling machines	628,809	399,730	275,813
Other milling machines	1,223,758	627,126	578,739
Gear cutting machines	331,371	268,595	272,286
Vertical drilling machines	106,998	121,621	34,730
Radial drilling machines	24,609	75,035	37,286
Other drilling machines	140,191	34,235	155,559
Planers and shapers	382,717	151,293	293,704
Surface grinding machines	283,993	193,667	155,735
External cylindrical grinding machines	209,248	214,493	164,466
Internal 3rinding machines	480,129	232,900	212,776
Tool grinding, cutter grinding and universal grinding machines	283,034	323,551	174,805
Other metal-grinding machines and parts	374,756	291,525	235,356
Sheet and plate metal-working machines and parts	353,550	238,647	831,092
Forging machinery and parts	301,374	394,220	53,917
Rolling mill machinery and parts	588,126	387,114	626,454
Foundry and molding equipment and parts	78,769	68,240	117,950
Other power-driven metal-working machinery and parts	829,356	838,610	607,090

Other Metal-Working Machinery

Pneumatic portable tools	$91,378	$111,469	$96,389
Other portable and hand or foot-operated metal-working machines and parts	103,354	132,120	113,248
Chucks for machine tools	28,735	19,486	58,404
Milling cutters, machine-operated threading dies and taps, and similar machine-operated metal cutting tools	51,058	72,355	38,384
Other metal-working machine tools and parts	66,418	68,475	31,798

SHOP EQUIPMENT NEWS

Fellows No. 18 Gear Finisher Employs Rotary-Type Finishing Tool



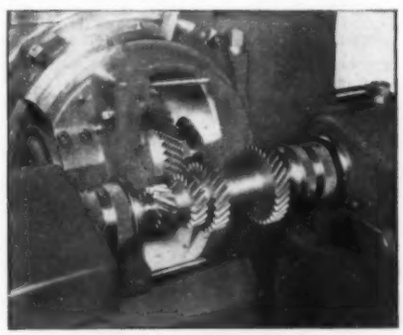
Both spur and helical external gears can be finished rapidly on the No. 18 gear finishing machine announced by the Fellows Gear Shaper Company. Both the "cross-axes" and the "parallel-axes" methods of finishing gear teeth can be employed, the adjustable head can be set to any desired angle

Two distinct methods of operation are possible with the No. 18 gear finishing machine announced by the Fellows Gear Shaper Co., Springfield, Vt., for finishing external spur and helical gears by a process employing a rotary finishing tool. This machine, which will be exhibited at the coming Machine Tool Show in Cleveland, is provided with head and tailstock slides and spindles, the latter carrying "live" centers upon which the work is mounted. Where the work is of the integral shank type it is held directly on the centers. Where it is provided with a hole, it is retained on an arbor and the latter is placed on the centers of the machine.

The rotary-type tool is held in an adjustable head that can be set to any desired angle for finishing both spur and helical gears. This head is mounted on a slide which is reciprocated rapidly. This rapid reciprocation of the tool is said to enhance the cutting action and to permit the removal of considerable material while producing a fine finish on the work. The combination of rapid reciprocation and high-speed rotation also results in the production of highly accurate gears.

The axis of the tool can be set at an angle with relation to the axis of the work, and the gear finished by what is known as the "crossed-axes" method, or the axis of the tool and the work can be set parallel to each other and the gear finished by the "parallel-axes" method. This latter method is particularly advantageous in the finishing of shoulder or cluster gears, where it is necessary for the tool to operate within a recess or close to a shoulder. The tool can either have straight or helical teeth, depending upon the direction of the teeth on the gear relative to the gear axis, and the necessary crossed-axis setting required to give best results. When employing the "parallel-axis" method, a spur tool is always used for spur gears, and a helical tool for helical gears. This has an advantage particularly in the finishing of spur gears in that one tool can be used for finishing gears having a large range in numbers of teeth, as long as they are of the same tooth proportion.

The machine is provided with complete electrical control, having two control panels. One panel is employed when setting up the machine and the other when operating. The finishing tool is advanced towards the work by means of a feed cam, and through electrical control, the required number of reciprocating cycles can be set depending upon the diameter of the work, pitch and other factors. The

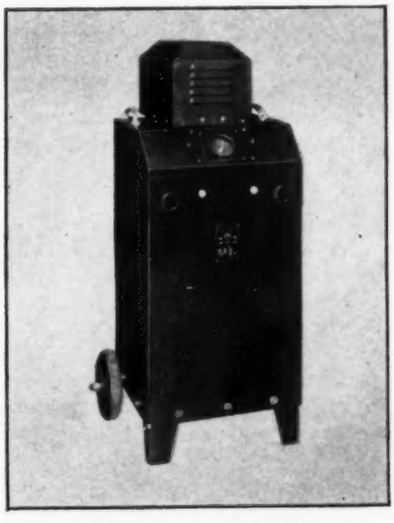


When employing the "parallel-axes" method, a spur tool is used for spur gears and a helical tool for helical gears. This method can be employed when operating close to a shoulder

machine stops automatically when a cycle has been completed. The machine has a capacity for spur and helical gears up to 18-in. pitch diameter, and 5-in. face width. Cutting time is controlled by change gears and the range is from 25 sec. minimum to 10 min. maximum.

Remote Control Sales Welding Time

The "G-R" remote control system developed by Sterling Products Co., 3380 Robertson Blvd., Los Angeles, Calif., regulates welding current for transformer-type arc welders without interrupting work or even breaking the arc. Six of the seven models of transformer-type welders manufac-

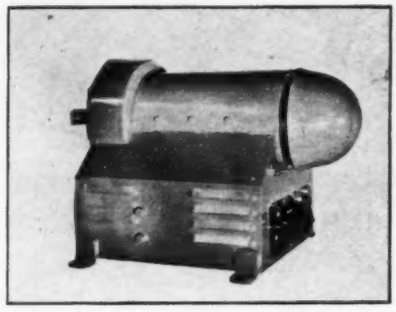


tured by this company now are available with this remote-control system; these range in size from the 20-125 amp. unit up to the heavy-duty industrial models with a maximum output of 1,250 amp.

The remote control operates through a compact switch mounted on the welding tongs. A low-voltage relay circuit operated by the tong switch controls a reversible motor which, in turn, operates the full-range "stepless" heat control. The operator thus has constant "finger-tip" control of welding heat.

Small Arc Welder For Small Shops

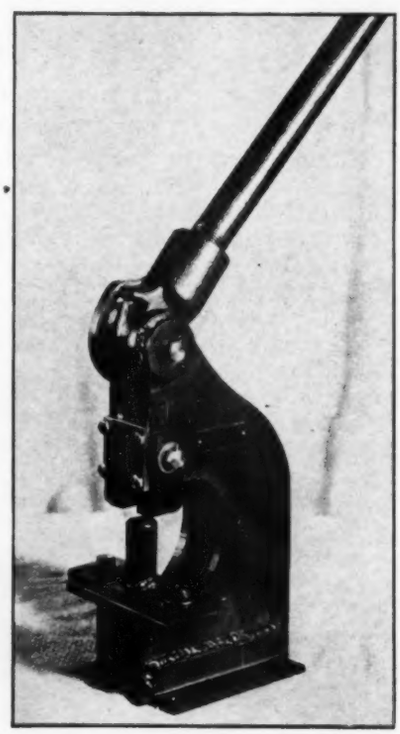
Known as the "Shield-Arc Junior", a small arc welder has been developed especially for use by garages, blacksmith shops, job welding shops, contractors and small machine shops by



the Lincoln Electric Co, 12818 Coit Rd., Cleveland, Ohio. The unit has been designed for use in conjunction with an engine or electric motor. It is rated at 200 amp. and its current range with a 30-volt arc, is 60 to 250 amp. Net weight is 250 lb. "Dual Continuous" control provides separate control of arc heat and arc penetration by permitting independent adjustment of voltage and current.

Bench-Type Punches Have Welded Frames

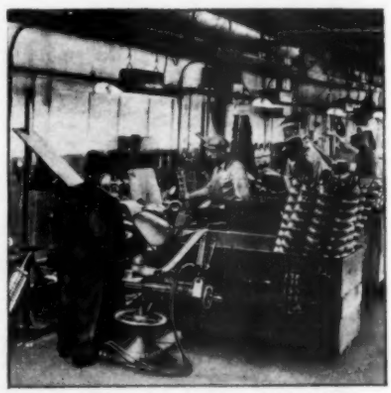
Arc welded construction is featured in the No. 37 and No. 38 "Little Blacksmith" punches manufactured by the J. F. Kidder Mfg. Co., Inc., 426 Colchester Ave., Burlington, Vt. The No. 37 punch shown has a throat depth of $2\frac{1}{2}$ in., and a capacity for punching $\frac{1}{4}$-in. diameter holes in $\frac{1}{4}$-in. thick mild steel. Three die holders with different heights are available for punching different sizes of irons.



The No. 38 punch has a throat depth of 24 in., but this is reduced to 6 in. when a supporting staybolt is used. The capacity without the staybolt is 2 in. in $\frac{1}{16}$-in. thick steel; and with staybolt is $\frac{3}{8}$-in. diameter in $\frac{3}{8}$-in. sheet steel. The throat is 3 in. high in the back. Weight of this unit is 470 lb.

Continental Offers Polishing Equipment

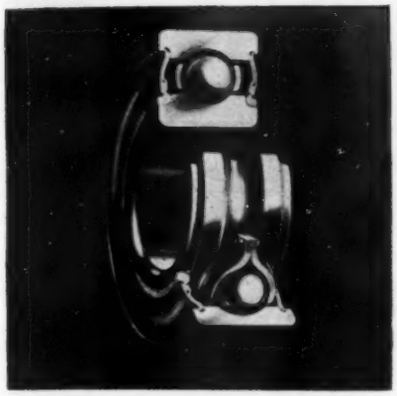
The Industrial Equipment Div., Continental Roll & Steel Foundry Co., East Chicago, Ind., is offering a line of automatic and semi-automatic



polishing and buffing machines, including automatic work holders and chucks for high production polishing and buffing of parts having polished surfaces on several planes. These machines feature pedal control, leaving the operator's hands free to pick up the next piece.

Double Felt Seal Bearing Made in Single Row Widths

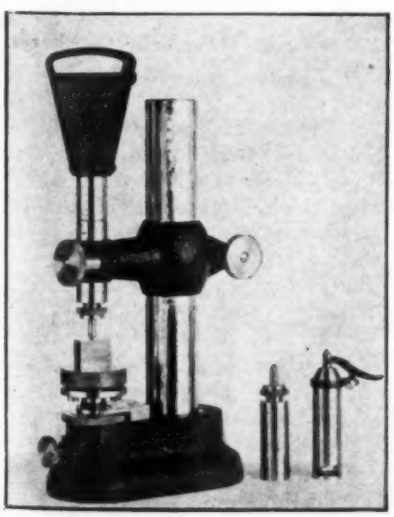
An outstanding development was made recently in sealed ball bearings by departing from the conventional stuffing box type of seal in favor of modern air-cleaner principles, sealing against dirt by the felt fiber contact on the polished surfaces of the inner race, and by utilizing the natural tendency of deflected felt to resume its original flat shape. The seal used in these bearings, made by the SKF Industries, Inc., Front St. at Erie Ave., Philadelphia, Pa., is one that can be applied to bearings having standard single-row S.A.E. dimensions of bore inner and outer race width, which up to the present time has not been possible except through the use of small balls and, consequently, loss of bearing capacity.



Known as the SKF Red Seal, and designated as the 6200 RS bearing, it is available for shafts up to approximately 1 in. diameter, and is suitable for a wide range of speeds. Tests have shown that the seal retains the bearing lubricant and excludes dust and dirt, yet the sealing action is so light that the friction drag has been reduced greatly.

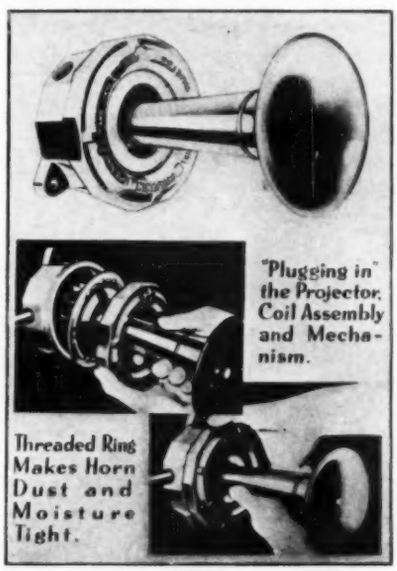
"Mikrotast" Gage Has Lever Movement

The fan-shaped indicator of the "Mikrotast" precision gage embodies a knife-edge lever movement and is furnished graduated either in 0.0005 or 0.0001 in., or in 0.0001 or 0.002 mm. Offered by Coats Machine Tool Co., Inc., 110–112 W. 40th St., New York, N. Y., this gage, in combination with other fixtures, may be used for free-hand external straddle gaging or for the internal gaging of rings and cylinders. In conjunction with either of the two adapters shown, it becomes a bench inspection gage of high precision. The thumb-nut on the ball-pointed adapter has a fine thread, and a slight turn lifts the gaging point out of contact with the work. The adapter equipped with a trigger serves the same purpose. The $2\frac{3}{8}$-in. diameter lapped table is equipped with micrometer adjustment from below. Maximum vertical adjustmnet is 7 in.



Signal Unit Features "Plug-In" Construction

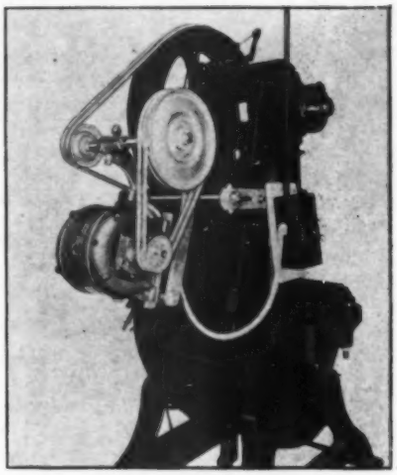
Better tone, greater volume and simplified assembly are features claimed for a line of howlers for industrial signal use announced by the Benjamin Electric Mfg. Co., Des Plaines, Ill. Turning a threaded ring detaches the howler from its base, and the entire assembly plugs into the base socket,



thus permitting units to be interchanged or replaced rapidly. Sound volume has been increased 100 per cent and distinctive tone giving greater signal audability has been achieved with no increase in current consumption. Howlers are available in either heavy-duty weatherproof or non-weatherproof types.

Improved Drive Unit Uses Standard Motors

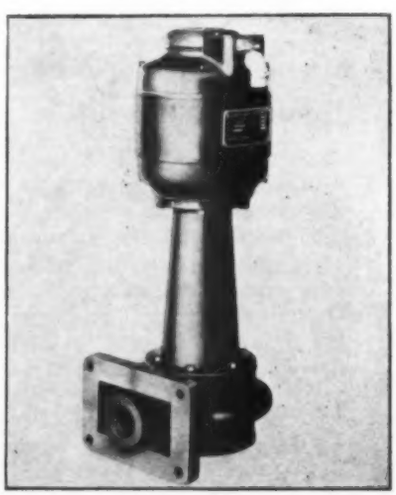
The " Modern" individual machine drive developed by the Quality Hardware & Machine Corp., 5847 N. Ravenswood Ave., Chicago, Ill., permits the conversion of various machine tools to individual motor drive, using standard 1,750–1,800 r.p.m. motors. Any desired operating speed in the usual ranges can be obtained by speed reduction through the "V"



belt and sheave drives. Essentially, the device consists of a frame which carries the motor base and the drive arm on which is mounted the final drive shaft. Construction is such that proper belt tension is maintained easily.

Modern Design Featured In Coolant Pump

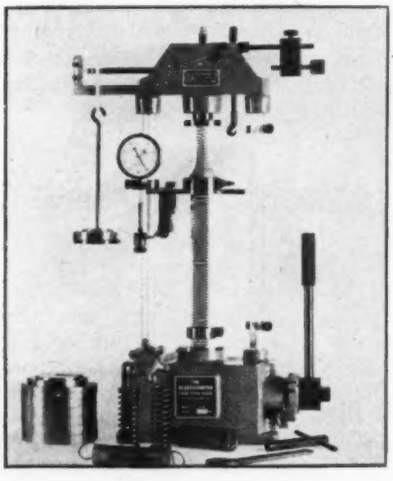
In keeping with the present trend to simplify machine tools, the Ruthman Machinery Co., Front & Pike Sts., Cincinnati, Ohio, has developed its flange-mounted Model No. 11023-E gusher pump which requires no external piping. The 3x5-in. inlet opens directly into the coolant reservoir, and the pump discharges through an outlet in the center of this intake opening. Thus it is possible to make all connections internally, confining piping to the inside of the machine housing. Pump has no packing glands, foot, relief or by-pass valves. There are no metal-to-metal contacts within the pump proper, enabling it to handle



abrasive-carrying liquids without injury. Shaft is carried in ball bearings sealed in the motor. Pump will deliver 65 gal. per min. when powered by a ½-hp. motor, 85 gal. per min. with a ¾-hp. motor.

Spring Tester Gives Accurate Measurements

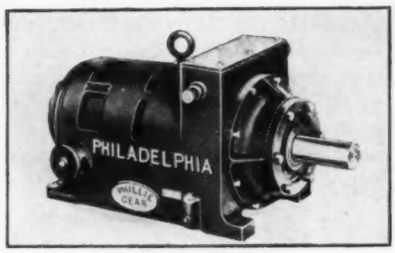
For testing the load of coil springs, either in compression or tension, at very accurate length measurements, the Model R-80 "Elasticometer" offered by the Coats Machine Tool Co., 110 W. 40th St., New York, N. Y., has been equipped with a dial indicator reading in thousandths of an inch. Having a total measuring range



of 1 in., the indicator is operated by the travel of the lower compression plates and can be set to zero by a convenient thumb-screw adjustment on its mounting bracket. Loose weights in the ratio of 1 to 10 are used for loading. Load capacity ranges from ½ oz. to 175 lb., length capacity from 0 to 12 in. Weight is approximately 70 lb.

Motor Drive Cuts Out Instantly at Overloads

A motor drive designed to protect machines that might jam or become overloaded has been developed by the Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa. The unit shuts the motor off automatically and instantaneously when the load exceeds a predetermined value. As soon as the excessive load is removed, the unit is ready to start without resetting. This motor drive, designated as the "PlaneTorque MotoReduceR" is supplied for horizontal or vertical drive

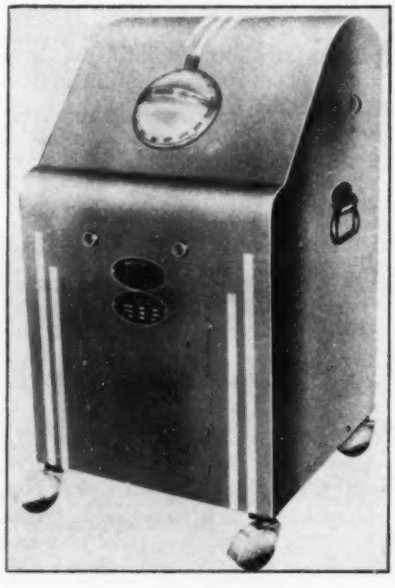


in all horsepowers and ratios for industrial use, and are furnished for clockwise or counter-clockwise rotation or for both if reversing service is desired.

The unit operates as follows: Whenever excessive torque is imposed on the output shaft of the drive, the increased torque required to rotate the planet gears mounted on the output shaft spider transmits a higher torque to the internal gear which is held in normal position by a lug and heavy spring. When the torque on the internal gear exceeds a predetermined value, the torque spring is compressed. This movement of the lug actuates the switch at the top of the unit.

Single Dial Controls A. C. Welder

A line of a.c. welders announced by Miller Electric Mfg. Co., Appleton, Wis., have combined amperage, voltage and reactance control in one dial which is so placed that the operator can adjust it without stooping to see the markings. He merely selects the amperage desired and the voltage and reactance change automatically. Built in four models ranging from 165 to 300 amp. in capacity, these welders



have been designed with a closed top so that nothing can fall into the wiring. Case is of all-steel arc-welded construction, with baked-on enamel finish.

Thermostatic Starter Protects Small Motors

The Type TT thermostatic starter announced by the Trumbull Electric Mfg. Co., Plainville, Conn., provides control and overload protection for a.c. or d.c. motors of 1 hp. capacity or less, through thermostatic action. This manual starter is made in both single and double pole types and pro-

vides quick make-and-break of its contacts. These contacts are silvered to insure long life. The starters can be arranged for flush or surface mounting. They can be furnished complete with heaters, or heaters can be purchased separately.

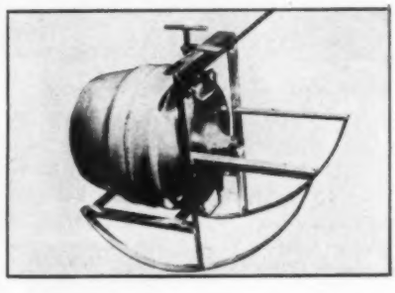
"Drive-All" Drive Unit Has Geared Head

The "Drive-All" motorizing unit announced by the Drive-All Mfg. Co., 3404 Conner Ave., Detroit, Mich., features a built-in four-speed or three-speed transmission. The single speed shift lever gives the operator his choice of either three or four speeds, depending upon the model selected. When using a two-speed motor, six or eight speeds would be available. These units can be applied to all types machine tools, power presses and production machinery. They will drive equipment requiring from one to five horsepower and the motor

rails are adjustable to accommodate different motors. Belt tension is adjusted easily and the belts may be guarded.

Light-Weight Pourer Handled by One Man

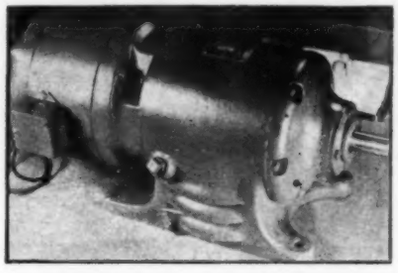
Development of a safety carboy pourer that is light in weight and can be handled easily by one man has been announced by Lewis-Shepard Sales Corp., 245 Walnut St., Watertown, Mass. Developed in cooperation wth the Aluminum Corp. of America to handle all-aluminum carboys, this unit is shown in pouring



position with the cap removed. Operation of the pourer is simple. With the carboy resting on its base, the pourer is placed over the top and clamped by means of a threaded handle below the shoulder. An easy pull on the handle brings the carboy over into pouring position, resting on a broad rocker base.

New "Ratiomotor" Unit Has Double Reduction

The Boston Gear Works, Inc., North Quincy, Mass., has announced the addition of the Type SME straight-in-line "Ratiomotor" to their regular line of speed reducers and motorized speed reducers. This motorized reduction unit is available with five output speeds and is equipped with $\frac{1}{2}$- or $\frac{3}{4}$-hp. motors. It has a double reduction drive which permits the unit to be disassembled if necessary into three unit parts for inspection or installation. These units are made up of the motor and motor pinion, the center housing with a driven internal and a driving spur gear mounted on one shaft, and the output and shield



and shaft with a driven internal gear. Precision anti-friction bearings are mounted on all shafts to take care of radial and thrust loads.

Sellstrom Safety Shield Uses Synthetic Material

Incorporating a window made of a synthetic material that will withstand heat, sparks and acid, the "Dependon" safety shield introduced by Sellstrom Mfg. Co., 615 N. Aberdeen St., Chicago, Ill., does not interfere with the wearing of prescription glasses or goggles. It is available

either in clear or tinted colors and is made in various depths from forehead to chin. The headband is easily adjusted and the window is attached by friction swivel joints which enable the wearer to raise the window entirely out of the way.

High Bay Lighting Units Have "Locklite" Feature

A high-bay aluminum reflector incorporating the "Locklite" principle of attaching industrial reflectors has been made available by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The "Locklite" feature is claimed to speed installation, reduce maintenance and provide increased safety with interchangeability of reflector units. These high-bay units are especially suited for lighting high narrow interiors where general conditions make it necessary to mount the units at great heights. They concentrate light distribution on working surfaces and do not waste illumination on upper side walls.

Air-Motored "Pneumix" Mixes 5-gal. Batches

The Type AB "Pneumix" clamp-type direct drive agitator, announced by the Eclipse Air Brush Co., Inc., 390 Park Ave., Newark, N. J., is designed especially for use in mixing 5-gal. batches. Design of this air-motor driven mixer includes all of the regular "Pneumix" features, such as variable speeds of 30–6,000 r.p.m.,

through air intake control, and elimination of fire and explosion hazards through air motor operation. This mixer is standard with a $\frac{3}{8}$-in. chromium plated or stainless steel shaft, 12 in. long, with one 3-in. triple-blade chromium plated bronze or stainless steel propeller.

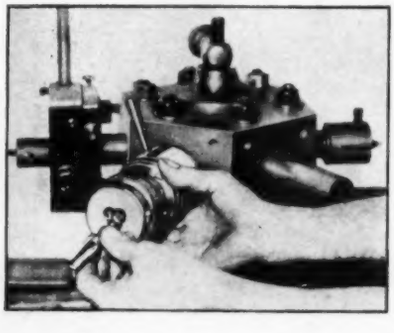
One-Piece Back Adds to Safety of Welders' Glove

The Industrial Gloves Co., 721 Garfield Blvd., Danville, Ill., has added a one-piece-back welders' glove to its line of industrial safety clothing. Burning out of seams has been minimized, as an extra wide leather strap protects and reinforces the thumb seam. Other seams are welted for

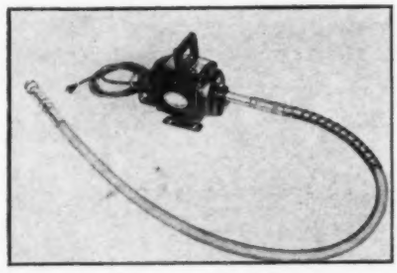
extra reinforcement at points of greatest wear. Designated as "Safeguard" No. 13475, the glove is manufactured from heat-resistant leather which is claimed to remain flexible under the most severe temperature conditions.

Collapsible Tap Offered For Rapid Set-Ups

Rickert-Shafer Co., Erie, Pa., has developed a collapsible tap for rapid set-up and fast change of chasers. It



requires only a quarter of a turn of the locking ring to release the chasers, and only a few seconds to insert a new set. Setting the holder for tripping is done from the front end by a short turn of the micro-adjusting trip ring. The same tool serves for either stationary or live spindle use, and taps all diameters down to $\frac{1}{2}$ in. Visible adjustment compensates for chaser wear.

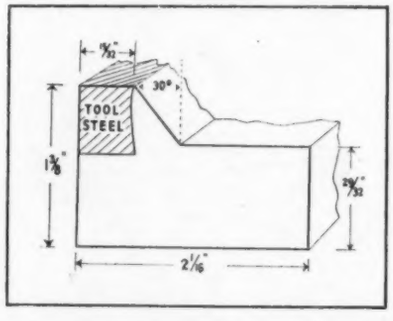


"Combination" Unit Has Carrying Handle

The Stow Mfg. Co., Inc., Binghamton, N. Y., has announced development of a combination model "Junior" flexible shaft unit which is designed for both bench and portable use. It is fitted with a conventional base, and also with a carrying handle. This Model AJ machine consists of a motor, flexible shaft, clamp spindle and extension cord and plug. Its principal application is to grinding, light drilling, polishing, sanding and filing operations.

Develops Special Section For Making Small Dies

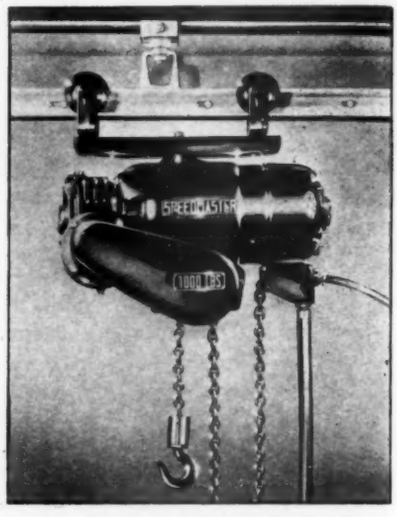
Designated as Section D, an additional rolled composite die section shape has been made available by Jessop Steel Co., 595 Green St., Washington, Pa., for making smaller dies such as those used in the manufacture of toys, re-



frigerators, containers, and similar articles. The section consists of a tool steel cutting edge backed by soft steel. Principal advantage over solid tool steel sections lies in the fact that they may be hardened before drilling dowel holes, thus eliminating lapping and assuring a good fit on the holder. It is claimed these composite die sections may be formed either hot or cold without harming the weld.

Rapid Operation Featured In "Speedmaster" Hoists

Available in capacities ranging from 250 to 3,000 lb., the "Speedmaster" electric hoists offered by the Master Electric Co., Linden & Master Aves., Dayton, Ohio, are equipped with powerful gearhead motors to assure maximum performance under adverse conditions. Limit switch operates so



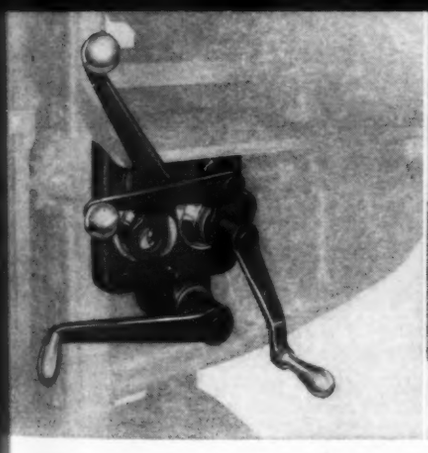
as to prevent overrun in both directions. Control is by means of a pistol grip switch. All models are anti-friction bearing equipped throughout and are available with rail, hook or lug mounting. Any desired length of lift can be provided.

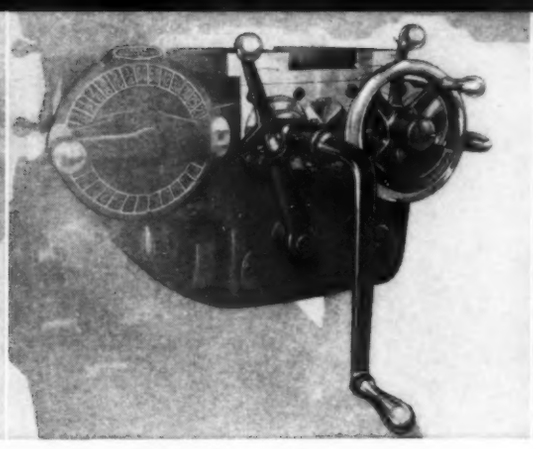
Barrett Floor Truck Has Hardwood Deck

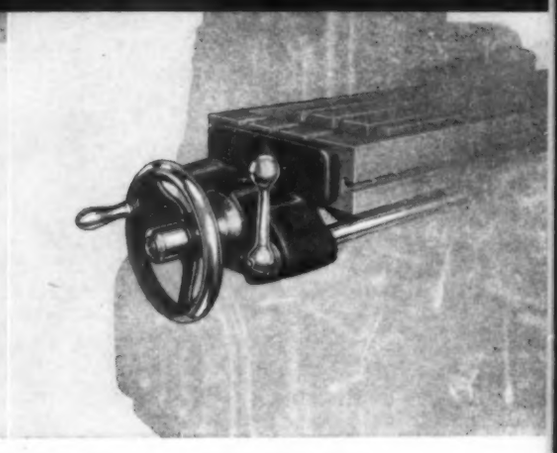
The hardwood deck of the improved floor truck introduced by the Barrett-Cravens Co., 3255 W. 30th St., Chicago, Ill., is bound with steel angles to prevent splintering and cracking at the edges. The semi-steel wheels

Centralized CONTROLS . .

DUPLICATED FRONT AND REAR . . .







On all 2K and 3K Milwaukee Milling Machines the operator can control all movements from either a front or rear position . . . all control levers have positive safety interlocks which prevent spinning handwheels and hand-cranks — no spring operated mechanisms.

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WEST ALLIS STATION — MILWAUKEE, WISCONSIN

THE FINEST ENGINEERED MILLING MACHINE

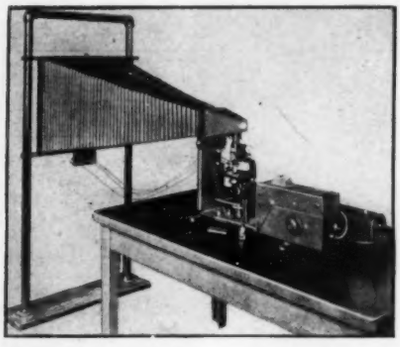
K&T

Milwaukee **MILLING MACHINES**

are made wide to provide greater bearing area. Brackets supporting the push bar can be removed to permit installation of a box, rack or shelf-type superstructure.

M.S.A. "Microprojector" Checks Dust Conditions

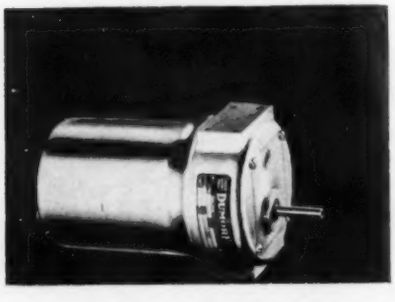
For industrial processes where dust control is desirable for economical or health reasons, the "Microprojector" offered by Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa., provides a rapid



and accurate method of periodically checking dust conditions. The instrument projects an image of a microscope's field upon a ruled, vertical, translucent screen. It provides a magnification of 1,000 diameters for counting and 10,000 diameters for particle size determination. Samples can be counted rapidly.

Type E1-Y Dunmore Motor Has Light Weight

Weighing only 3 lb., the Type E1-Y aircraft motor, announced by Dumore Co., Racine, Wis., has a speed range of 200 to 1,200 r.p.m. with a capacity range of 1/20 to $\frac{1}{16}$ hp. Originally developed for use on airplanes and wound for 12 or 24 volts, it now



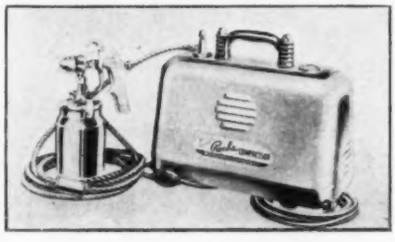
can be wound for 115 volts where an inline drive is required. Gearing is of the spur type and the brushes and commutators are large enough to handle heavy currents.

Stub Taper Center Drill Increases Accuracy

Greater accuracy is claimed for the stub taper center drill announced by the Cogsdill Twist Drill Co., 6511 Epworth Blvd., Detroit, Mich. This is said to be accomplished by dispensing with eccentric driving methods, as the new drill and its adapter are concentric as a unit. Spindle error is minimized because of shorter distance between spindle and drill. Breakage is claimed to be reduced by grinding the drills radially from the center.

Portable Sprayers Have High Efficiency

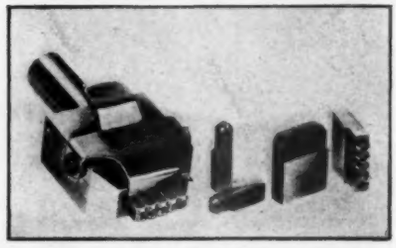
Danger of overheating is claimed to be completely eliminated in the "New Roche" line of portable paint sprayers developed by the Binks Mfg. Co., 3114–26 Carroll Ave., Chicago, Ill. Streamlined design has made possible an efficient forced draft cooling sys-



tem and promotes safety through elimination of exposed moving parts. Compressor weighs approximately 40 lb. and is provided with a convenient carrying handle. Built to withstand plenty of rough usage, it is powered with a General Electric motor which can be used on either a.c. or d.c. power.

"Hercules" Type Holder Offered in Several Types

The "Hercules" interchangeable type holder, announced by H. O. Bates, 251-257 N. Broad St., Elizabeth, N. J., is made entirely of one piece of shock-resisting alloy tool steel, except for two hardened steel blocks that complete the welded assembly. It is made in either the press style shown, a hand style with tapered shank, or a hammer style. Type or



dies for this holder can be furnished as single characters, groups of characters, trade marks, symbols or emblems. The holder and type can be constructed for marking on curved surfaces.

"Ultra-Chex" Standards Offered by George Scherr

The George Scherr Co., 128 Lafayette St., New York, N. Y., has placed on the market a set of precision measuring standards under the trade name

of "Ultra-Chex." The set consists of nine standards said to be accurate to eight millionths of an inch and will make 71 combinations in steps of $\frac{1}{16}$ in. up to $4\frac{7}{16}$ in., and 41 combinations in sets of 0.100 in. up to 4.1 in. Also available with the set is an optical parallel which can be used to check the parallelism of micrometer anvils by observing light interference bands on both anvils.

Carboloy Develops New Carbide Grade

Carboloy Co., 11185 E. Eight Mile Road, Detroit, Mich., has developed a special carbide containing a combination of tungsten, tantalum and titanium carbides. Known as Grade 78, it is said to represent a marked improvement over the previous grades of titanium carbide. It is claimed to be capable of making cuts as heavy as $\frac{3}{8}$ in. with feeds up to $\frac{3}{64}$ in. per revolution in machining steel bars and castings.

SEE THE MACHINES *that will make tomorrow's Profits*

"The evidence is everywhere about us . . . of what machinery can do to make life easier, simpler and richer."—Henry Ford.

Visitors to the Machine Tool Show in Cleveland will see the greatest exhibit ever held of the modern tools of industry. Here's the key to progress and profits in manufacture! Here are improvements that will "make life easier, simpler and richer" for the producer of goods as well as the consumer.

This Show is being held for the benefit of those who have a serious interest in better manufacturing methods — executives, operating men, engineers and financial men. Such men cannot afford *not* to come, and it is for them this great Machine Tool Show and Congress are being held.

If you are interested in the returns that can be earned by better machine tools, this will be your opportunity.

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OF 1939

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to be capable of making cuts as heavy as $\frac{3}{8}$ in. with feeds up to $\frac{3}{64}$ in. per revolution in machining steel bars and castings.

Several Self-Contained Bearing Units Offered

Stephens-Adamson Mfg. Co., Aurora, Ill., has added self-contained flange and take-up bearing units to its line of permanently sealed "Sealmaster" ball bearing pillow blocks. The group of flange units, available in shaft sizes from $\frac{7}{8}$ to $2\frac{7}{16}$ in., consists of standard duty self aligning ball bearings mounted in a rigid one-piece housing. Take-up units, available in same shaft sizes and containing identical bearings, have been designed for mounting between guides, for use in adjusting shafts and tightening belt bearings.

Power Transmission Belt Made of Neoprene

In answer to the demand for a belting which will withstand the destructive action of mineral oils, the Hewitt Rubber Corp., Buffalo, N. Y., has placed on the market an all-Neoprene friction-surface transmission belt. Known as "Duroil Hewprene", it is claimed to provide high flexing life over high-speed pulleys. Friction and skim coat of rubber between all plies protect the cotton duck against wear, ply separation, and softening from oil. Belting is claimed to hold wire fasteners exceptionally well under the severest conditions.

Chaser Holders for J & L Die Head

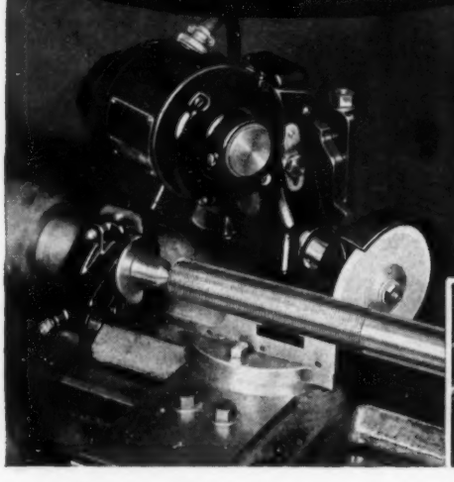
Jones & Lamson Machine Co., Springfield, Vt., has made available three sets of chaser holders for its Model 22 tangent die head to increase its capacity and make it more versatile when the job changes are frequent or where a die with large threading range is required.

Capacity of these holders, which take the standard Model 21 die chasers, ranges from $\frac{1}{4}$ to $\frac{3}{4}$ in. and from $\frac{3}{4}$ to $1\frac{1}{4}$ in. Holders with a capacity from $1\frac{1}{8}$ to $1\frac{1}{2}$ in. are also available. Each set will accommodate any diameter and pitch thread within the capacity of the die.

National Counterbores

A recent item in this department described the new line of spline taper drive counterbores announced by the National Twist Drill & Tool Co., 6522 Brush St., Detroit, Mich. (*AM*—Vol. 83, page 622). Unfortunately an error was made in putting the head on this item. The head as printed read "Morse Counterbores Available in Sets". It should have read "National Counterbores".

NOW.. GRIND THREADS at a FRACTION of Former Cost

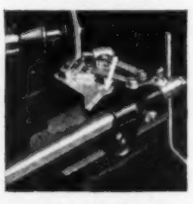


New ATTACHMENT For DUMORE No. 5 Precision Grinder Revolutionizes Thread Grinding

Replace regular mounting post with special one.

Set up grinder by easy-to-follow instructions.

Clamp the wheel dressing attachment to lathe.



Dress wheel and you are ready to grind threads.

Quickly, easily convert one of your lathes into a precision machine for grinding threads. An amazing new attachment for a Dumore No. 5 Grinder does the trick . . . costs but a small fraction of the usual investment for special thread grinding machines . . . requires no installation expense . . . no extra power . . . ties up no large amount of capital. Can be set up and operated by anyone who can chase a thread. Ask your Dumore distributor for complete information and an actual demonstration in your plant. No obligation.

EASY TO SET UP AND OPERATE

A few simple rules to follow and the Dumore attachment converts a lathe and your Dumore No. 5 Grinder into a thread grinding machine.

THE DUMORE CO., Dept. 139-J RACINE, WIS.

DUMORE

PRECISION GRINDERS

TRADE PUBLICATIONS

BALL JOINTS Several types of revolving flexible ball joints for supplying fluids from a stationary supply pipe to a rotating member are described in Catalog No. 291, issued by the Barco Mfg. Co., 1801 Winnemac Ave., Chicago, Ill.

CEMENTED CARBIDE Engineering bulletin No. GT-114, issued by the Carboloy Co., Detroit, Mich., contains twelve pages of recommendations for cutting steel, cast iron, non-ferrous metals and non-metallic materials.

DEAERATORS Features of a line of vertical double-element type deaerating heaters and deaerators are provided in a 6-page illustrated folder,

Bulletin W-210-B24, offered by the Worthington Pump & Machinery Corp., Harrison, N. J.

DIE CUSHIONS Bulletin No. 5-1, issued by the Dayton Rogers Mfg. Co., Minneapolis, Minn., contains four pages of engineering data concerning the Model "C" pneumatic die cushions.

DRILLS Catalog No. 96, published by Whitman & Barnes, Div. United Drill & Tool Corp., Detroit, Mich., contains 86 pages of engineering data, specifications and recommendations concerning an extensive line of twist drills, reamers, counterbores and machine shop accessories.

GRINDERS Type BPA grinders with interchangeable spindle units for internal and external grinding are described in illustrated Bulletin No. 162 published by The Standard Electrical Tool Co., 1940 W. 8th St., Cincinnati, Ohio.

GRINDING A wheel speed chart made available by the Landis Tool Co., Waynesboro, Pa., provides a convenient method of determining proper wheel and work speeds for a wide range of grinding conditions.

INSTRUMENTS A 6-page illustrated folder issued by the Leeds & Northrup Co., 4911 Stenton Ave., Philadelphia, Pa., discusses features of the "Rayotube" for difficult high temperature measurement applications.

NEW BOOKS

SEVENTH INTERNATIONAL MANAGEMENT CONGRESS: PROCEEDINGS —*340 pages, 8¼ x 11¾ in. Indexed. Paper binding. Published by the National Management Council of the U.S.A., 347 Madison Ave., New Yok U. S. A., 347 Madison Ave., New York, N. Y., Price for set of seven volumes, $7.50; seventh volume alone, $2.00.*

This volume is a record of the Seventh International Management Congress held at Washington, D. C., September 19–23, 1938. It provides a full record of the week's meetings, giving the text of all addresses at the general sessions of the Congress and a summary of the discussion of technical papers contained in the first six volumes. Also included is a complete outline of the Congress organization including officers, committees, secretariat roll of honor and a list of the members.

Automotive Steels

By E. F. DAVIS
Warner Gear Division, Borg Warner Corporation

Of recent years there has been an increased trend toward the employment of fine grained steels and a demand on the steel mills for grain control. Certain types are normally fine grained, such as the chrome-vanadium steels, whereas others are normally coarse. But to make the majority of the alloy steels coarse or fine grained to demand is a recent accomplishment; today either type may be made at will.

The reason fine grained steels have become so popular is their ability to be hardened without undue brittleness, but maintaining toughness and resiliency after hardening due to the shallow hardening properties. With the carburizing steels, direct quenching after carburizing is becoming more and more the standard practice. By this method of hardening no further heat-treatment is given the steel except a low temperature tempering after quenching. Modern steels do not coarsen at the carburizing heats and no more heat distortion occurs than at lower heats,

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thus simplifying the hardening practice. Until the steel industry was able to insure grain size such a practice would have been unwise.

In both carbon and alloy steels of fine grain microstructure the problem of machining has been difficult where smoothly machined surfaces are prerequisite. To improve this condition attempts are being made to introduce other elements into steel to compensate for the fineness of grain and inherently stringy characteristics.

Sulphur and phosphorus are well known aids to machinability, but in steels of better quality both of these are often taboo and their use is mostly confined to the free cutting applications. Phosphorous is undesirable on account of its treacherous cold short properties, but sulphur is claimed to be advantageous when purposely incorporated in the ladle and is not residual sulphur.

Many of the rarer elements have been tried out and some of these have shown promise. Elements such as zirconium, selenium, columbium and uranium are prohibitive additions for production steels, although some of these are used in the 18-8 stainless steels and have proven to aid machining properties. Zirconium in small quantities has been found beneficial in improving machinability in the higher manganese steels. An important contribution to this problem is a recently developed steel containing lead.

Lead does not alloy with iron, but occurs scattered through the matrix in finely divided particles of metallic lead, often displaying the characteristic cubicle pattern. But in rolled and forged steels it is found most frequently in long stringers which sometimes, under high magnification, have the appearance of vertebrae. Lead, being a plastic, would conform to the strain lines of rolling and forging. These stringers are presumed to be effective in breaking up the continuity of the ferrite, thus improving machinability.

When this steel is properly made some remarkable results have been reported. On one job where S.A.E. 1115 steel was specified to make a small plunger eleven seconds were required to produce it. When lead was introduced into this same steel the time required was reduced to 3½ sec. This was cold drawn steel with turning and cut off operations on a six-spindle automatic. On fulcrum shafts of S.A.E. 1020, which is always a bad machining steel on automatics, the addition of lead proved to be beneficial. On several jobs the surface speed was increased from 75 to 125 surface ft. per min.

It should be realized that if segregation of the lead occurs, and the speeds and feeds have been increased to compensate for the lead additions, very unfavorable experience would result with leaded steel. This may account for some of the varied reports of its value. It is questionable whether it imparts any valuable improvement to the high sulphur or free cutting steels. Its beneficial properties are not so marked on the alloy steels and varied reports have been given of its value. Lead has one advantage in that it does not seem to impart any unfavorable properties to steel. The leaded steel can be rolled and forged readily, it carburizes and hardens satisfactorily. Impact does not seem to be materially affected.

Other means are being investigated toward improving machinability. In the molybdenum alloy steels molybdenum sulphide instead of calcium molybdate or ferro molybdenum as an addition is claimed to produce better machining steels. Another is an addition of sodium fluoride and litharge. To improve physical properties by the elimination of oxides, nitrogen and other gases are being

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RYERSON CERTIFIED STEELS

RYERSON

used. To promote the coalescence of inclusions several new deoxidizers are being employed.

The carbon - molybdenum, or "Amola" steels, have been in use for about five years, hence cannot be regarded as new, but during this period most of the production has been confined to one large automobile industry and the parts makers supplying them. Not until recently has its adoption become more general. Until 1938 the examination prior to sale was confined to the laboratory of those responsible for the development of this steel. This was, of course, objectionable to competitive car manufacturers and restricted its acceptance. On the other hand this no doubt was a wise procedure because much had to be learned regarding the correct way to manufacture it.

In this steel advantage has been taken of that unfortunate term known as abnormality which was conferred on fine grained steels a number of years ago. No doubt abnormal steels at that period were over-oxidized heats doctored in the ladle with generous additions of aluminum and did characterize poorly made steel. But the entire structure upon which this development is based is upon a fine grained abnormal microstructure having more or less indefinite grain boundaries.

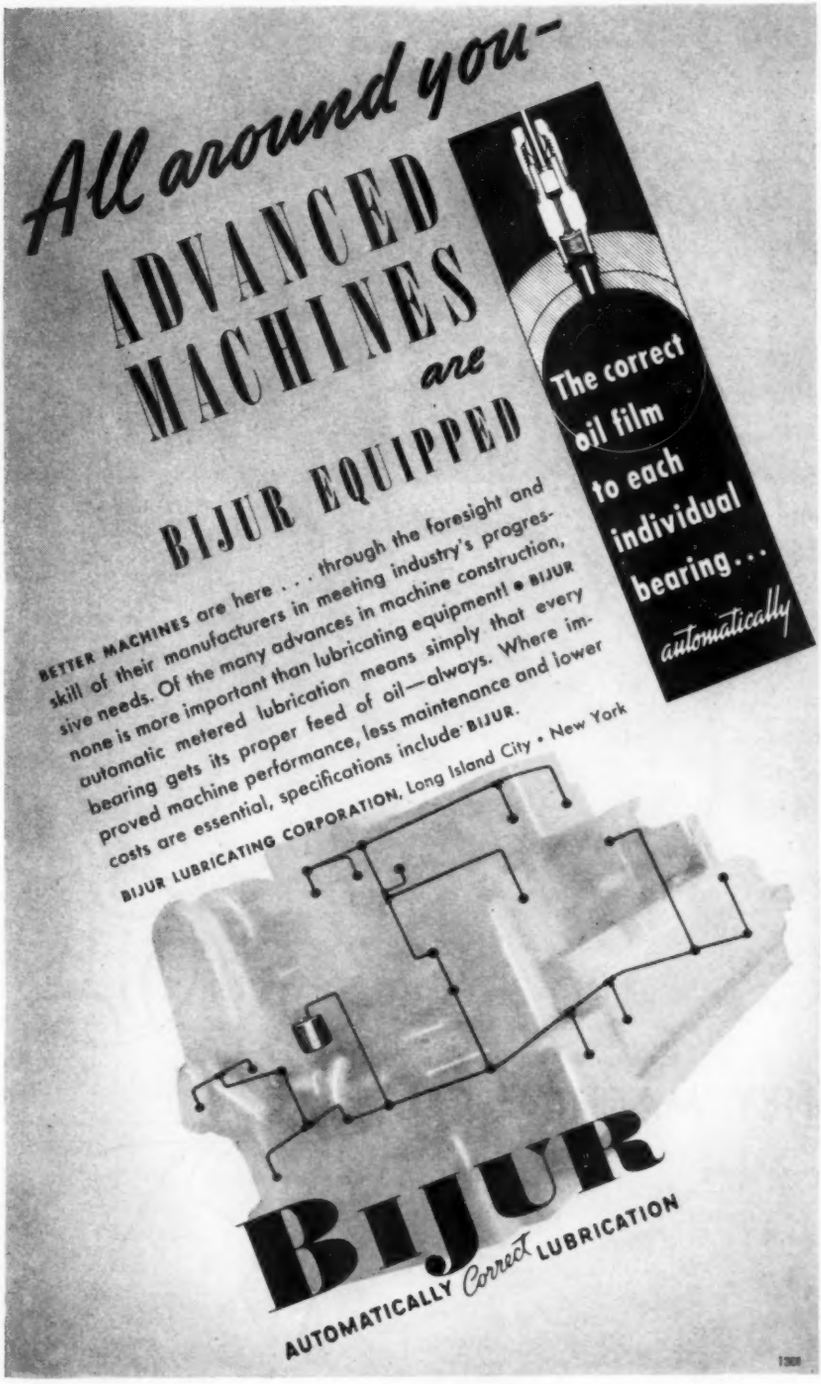
By great care in setting up the steel practice and the judicious employment of molybdenum it has been possible to produce an abnormal steel capable of imparting the desired fibrous characteristics, excellent strength and at the same time regulate the chemistry so the steel would not be difficult to harden.

These steels cover a range of 0.20 to 0.70 per cent carbon and all show 0.15 to 0.25 per cent molybdenum, which is the only alloy used. However, due to the employment of molybdenum and the exacting set-up for its manufacture, it is classed as an alloy steel. The carburizing grades are usually between 0.25 and 0.35 per cent carbon. This is a departure from the usual 0.10 to 0.25 per cent which represents the average carbon limits for the carburizing grades. Also the oil hardening types are generally 5 to 10 points higher in carbon than an equivalent type of other alloy steels. The object of this is to improve the hardenability. These steels show very little distortion in heat-treatment.

In many of the automobile plants the trend has been toward cheaper steels. Several have almost entirely eliminated the use of alloy steels and have substituted what might be termed the deluxe high manganese carbon steels made with special deoxidizers. These steels vary from 1.30 to 1.90 per cent manganese corresponding to the S.A.E. 1300 series. These new manganese steels are quite an improvement over the older type although the actual chemistry of the steel has not been greatly modified. Even transmission and rear axle gears are being fabricated from these steels. Their success requires accurate control of grain size, hardenability and physical properties.

There is a growing increase in the employment of medium carbon-nickel-molybdenum steel for cyanided gears. This is S.A.E. 4640 which was first recognized by the Iron and Steel Committee of the S.A.E. in 1935. This steel was first adopted by Warner Gear Company but its high strength, excellent impact and fatigue resisting properties, and more important its minimum distortion in heat-treatment, has resulted in gear makers adopting it.

Briefed from a paper entitled "What is New in Heat-Treating Methods, Materials and Processes" presented before the World Automotive Engineering Congress of the Society of Automotive Engineers at Detroit, Mich., June 2, 1939.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In actual thread production, "HANSON PROCESS" TAPS give outstanding evidence of superiority in clean, accurate threads—in more threads between grinds—in longer service on toughest jobs.

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